Patient Monitor

Operator Manual

Welch Allyn

Service Manual

Atlas Monitor

Welch Allyn Medical Division
4341 State Street Road
P.O. Box 220
Skaneateles Falls, NY 13153-0220

6200-43E

Part No	Rev	Description	ECN #	Date	Approved
6200-43E	A	New Release of ATLAS Service Manual	5-40429	10/99	RS/LP

Drawings and/or illustrations and/or part numbers contained in this document are for reference purposes only. For current revisions call the Welch Allyn Customer Service phone number listed in Section 1 page 2.

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Appendix Section:

1.1 About the Atlas Monitor

The Atlas combines in one unit all the necessary measurements for patients under anesthesia, for surgical recovery, or bed side monitoring. See Section 1.3 for a complete listing of product models and options.

According to the standards of care for Nurse Anesthetists and Anesthesiologists, all patients receiving conscious sedation are to be continuously monitored throughout the procedure and recovery phase by ECG, SpO_2, and NIBP. CO_2 monitoring is a requirement during gas anesthesia (when patient is ventilated).

The Atlas combines a CRT to display ECG and CO_2 waveforms and LEDs for the other numeric values to maximize visibility and viewing angle. Although not designed to be a transport product, the monitor has an integral handle and it is small and light enough at 13 lb to be easily moved. A one hour battery enables the monitor to be moved with the patient from the surgery room to recovery room. It also maintains unit operation for up to an hour when power is interrupted.

IMPORTANT: for a complete description on the function and use of the Atlas, as well as user safety warnings, cautions, and warranty information, read and understand the Atlas Operator's Manual part number 6200-42E (English). Other languages are available.

1.2
Help Information

All service and repairs must be performed by fully trained and properly equipped personnel, using genuine replacement parts and correct procedures. Failure to do so will invalidate the product warranty.

Safety Warnings

Read and understand all safety warnings and service notes printed in this Service Manual and the Operator's Manual part number 6200-42E. If in doubt about any precaution or procedure, for phone help, or to order additional copies of the Atlas Operator's Manual, contact:

Customer Service
Welch Allyn, Inc.
4341 State Street Road, PO Box 220
Skaneatles Falls, NY 13153-0220 U.S.A
Telephone 1-800-535-6663

When calling, refer to the model number on the bottom of the Atlas. The Model Number is the first three digits of the Serial number number found on the bottom of the Atlas.

Treat all returned opened Nasal CO2 Sample Lines and watertraps as Bio Hazard material and dispose of them in an approved manner.

Troubleshooting assistance is contained in Section 3 of this manual to help determine which board is malfunctioning. This manual does not support repairing the printed circuit boards.

Year 2000 Information: The Atlas is Y2K compliant and will not encounter "Year 2000" problems.

1.3 Product Model Number Structure

621S0 ECG, Nonin SpO_2, NIBP

621SP ECG, Nonin SpO_2, NIBP, Printer

622S0 ECG, Nonin SpO_2, NIBP, Temp, Respiration, Battery, RS232

622SP ECG, Nonin SpO_2 , NIBP, Temp, Respiration, Battery, RS232, Printer

622N0 ECG, Nellcor SpO_2, NIBP, Temp, Respiration, Battery, RS232

622NP ECG, Nellcor SpO_2, NIBP, Temp, Respiration, Battery, RS232, Printer

623SP ECG, Nonin SpO_2, NIBP, $ETCO_2$, Temp, Respiration, Battery, RS232, Printer

623NP ECG, Nellcor SpO_2, NIBP, $ETCO_2$, Temp, Respiration, Battery, RS232, Printer

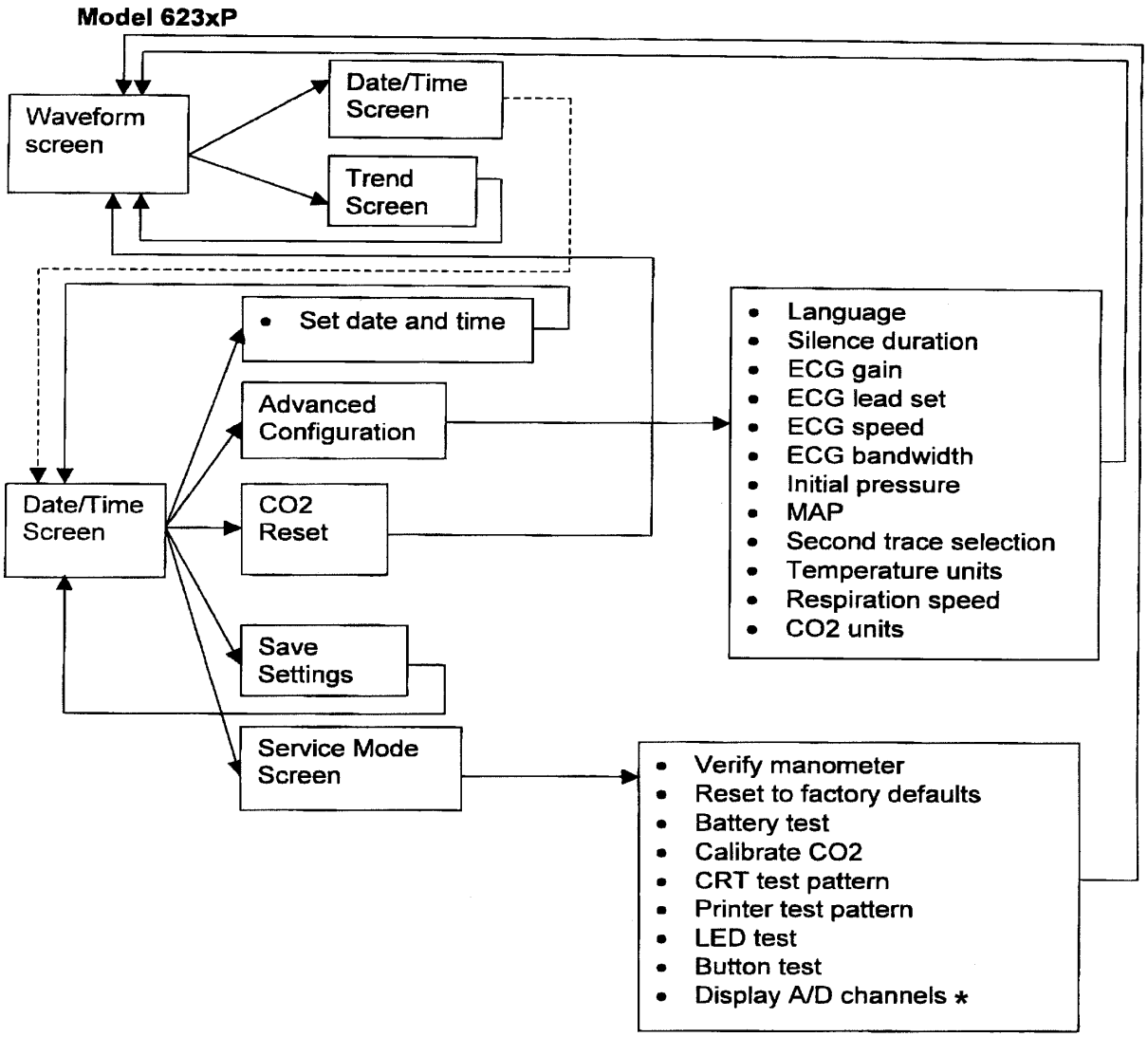
SUFFIX:

Use letter designation for language localization as follows:
E = English, F= French, G= German, I= Italian, S= Spanish, P= Portuguese C = Chinese, J= Japanese

Use number designation for line cord localization as follows:

1 = US, Canada, Japan Version
2 = European Version
4 = United Kingdom Version
6 = Australian Version

1.4 Main Menu Architecture

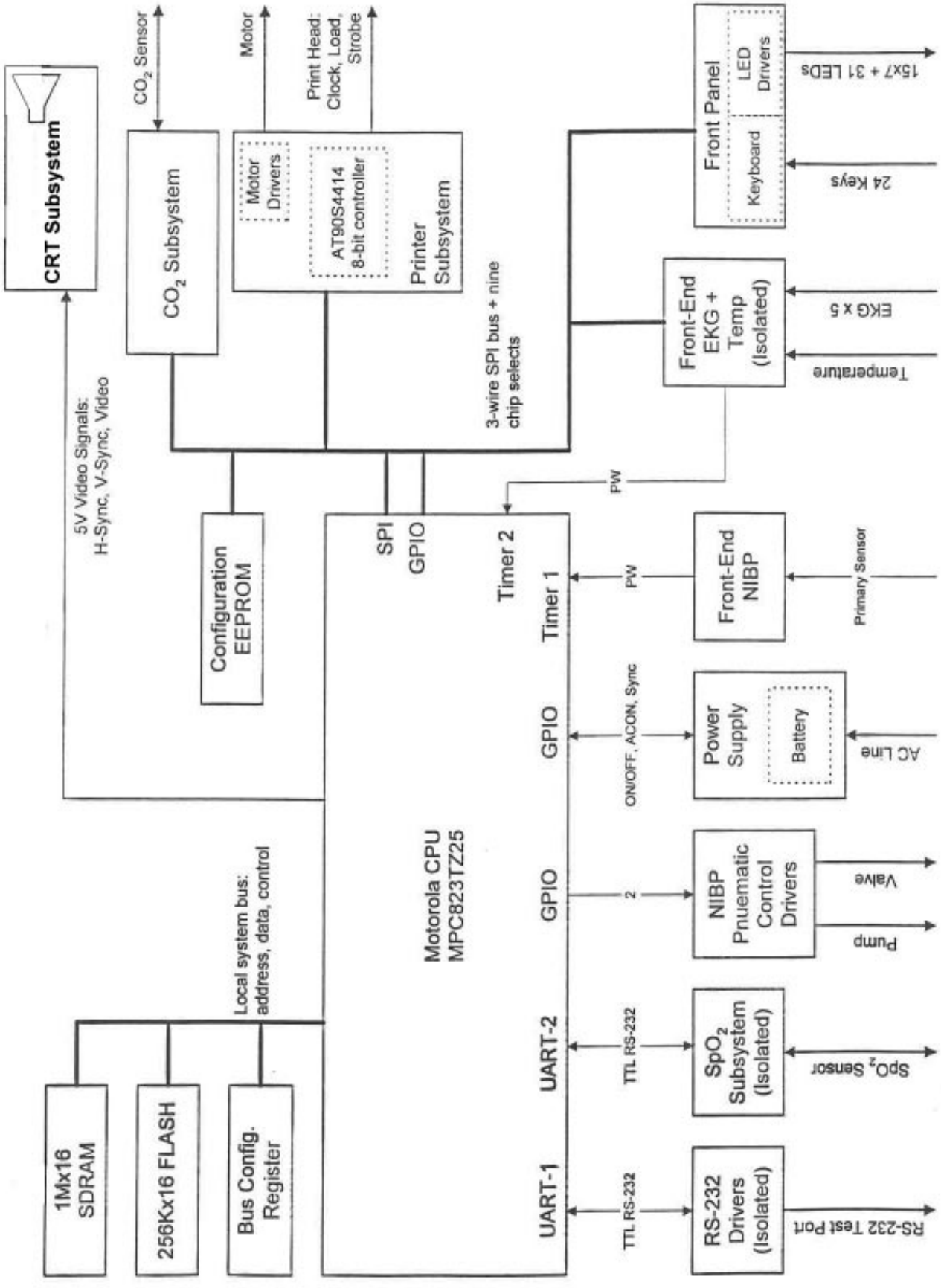


Also note that this is for the 623xx system.

- On a 622xP system, delete the **CO_2 Reset box**, the **Calibrate CO_2** item, and the **CO_2 units** item.
- On a 621xP system, delete the **CO_2 Reset box**, the **Calibrate CO_2 item**, the **CO_2 units** item, **Respiration speed** item, the **Temperature units** item, and the **Battery test** item.
- On systems without printers (621x0 and 622x0) delete the **Printer test pattern** item.

***** The Display A/D Channels also lets you press <SET> up and down to display additional sets of information, but does not change the menu page that you are on, just writes different information on the right side of the screen.

Section 1.5 Atlas System Block Diagram



2.1 Incoming Inspection

☐ 2.1.1 Inspect shipping package and product for damage. Make a record of possible shipping damage.

2.1.2 List accessories in box.

☐ power cord
☐ SpO_2 probe
☐ ECG leads
☐ ECG lead cable
☐ Cuff(s)
☐ Operator Manual
☐ nasal $C0_2$ Line
☐ ECG Electrode(s)
☐ temperature probe
☐ BP tubing
☐ paper
☐ loose parts, describe

☐ 2.1.3 Clean and disinfect by following the instructions printed in the Operator Manual.

☐ 2.1.4 Operate the Atlas to verify the customer complaint before making any changes to the unit. Call the customer if the complaint is unclear.

NOTE: Perform REPAIR TESTS in Section 2.2 to fully inspect the Atlas monitor before and after servicing. Refer to Section 3 for Troubleshooting help.

2.1.5 If the unit has caused or is suspected of having caused an injury of any type:
DO NOT DISASSEMBLE OR REPAIR THE UN IT IN ANY WAY.
Contact Welch Allyn Customer Service immediately.

Service Intervals for Calibration and Maintenance are listed in Atlas Operator's Manual Appendix C.

2.2 Repair Tests

BP Leak Test

2.2.1 Blood Pressure System Leakage Test:

Unit must not leak more than 5 mmHg in a 15 second interval while attached to a 100 cc volume at test pressures of 50mmHg and 250mmHg.

Need:

100cc (+10/-0cc) test cavity
stopwatch
squeeze bulb

2.2.1.1 Connect Atlas to test 100cc volume and Setra Gage as shown in Figure 2.3.1.1

2.2.1.2 Turn Atlas ON

2.2.1.3 Press Time and Date button to access Options Menu.

2.2.1.4 Press Lead Select button to select Service Mode. Select Verify Manometer

2.2.1.5 Pressurize the Atlas with squeeze bulb to 50mmHg.

NOTE: Allow reading to stabilize for 15 seconds.

2.2.1.6 Observe pressure for 15 additional seconds. Unit should not leak more than 5mmHg during this time.

2.2.1.7 Perform this process at 250mmHg

BP Dump Test

2.2.2 Dump Test:

Unit must be able to deflate a 500 cc volume from greater than 260.0 mmHg to less than 15.0 mmHg in 10 seconds or less.

Manometer Accuracy Test

2.2.3 Manometer Accuracy Test

Internal temperature of the unit must be less than 32.0 degrees Celsius before performing test.

2.2.3.1 The primary transducer must be within +/- 0.75 mmHg at 0 +/-0.3 mmHg. The safety transducer must be within +/-1 mmHg at 0+/-0.3 mmHg.

2.2.3.2 The primary transducer must be within +/- 1.5 mmHg at 50 +/-5.0 mmHg. The safety transducer must be within +/-1.5 mmHg at 50 +/- 5.0 mmHg.

2.2.3.3 The primary transducer must be within +/- 1.5 mmHg at 150 +/-5.0 mmHg. The safety transducer must be within +/-4.5 mmHg at 150 +/- 5.0 mmHg.

2.2.3.4 The primary transducer must be within +/-

2.2.4 Deflation Test:

With the unit connected to a large adult cuff and a target inflation pressure of 200 mmHg* have the unit perform a complete “normal” BP cycle.

For steps two and three, the size of the step must be between 3.0 mmHg and 11.0 mmHg. Step 4 and all other steps above or equal to 40 mmHg, step size must be between 7.0 mmHg and 11.0 mmHg. All steps below 40 mmHg, except for the last step, will be between 4.5 mmHg and 10 mmHg. The last step will be between 0.01 mmHg and 10 mmHg.

Deflation Test

*** Go to service mode screen and set initial pressure to 200mmHg.**

2.2.5 Charge Voltage Test:

Check battery charging circuit:
Specification :No Load: 6.85VDC across right pin (+) and left pin (-) of Main PCB battery charge connector.

Charge Voltage Test

2.2.6 **Hardware Fail Safe Tests**

2.2.6.1 Over Pressure Test:
Atlas hardware must detect over pressure on unit pneumatic system between 296.0 mmHg and 329.0 mmHg.

2.2.6.2 Over 15 mmHg Test:
Atlas hardware must detect if the pneumatic system has been pressurized greater than 15 mmHg for more than 155 seconds but less than 180 seconds.

2.2.6.3 Under 15 mmHg Test:
Atlas hardware must detect if the pneumatic system has been pressurized less than 15 mmHg for more than 25.0 seconds but less than 35.0 seconds before alowing new inflation cycle in “non-Stat” Auto Mode.

Hardware Fail Safe Tests

2.2.7 RS232 Test:

The RS232 communication operation will be confirmed with successful serial transmit and receive.

RS232 Test

2.2.8 Printer Option Test:

The printer must be able to print out the test pattern . Inspect print quality.

Printer Option Test

ECG Test

NOTE:
Section 3 of this Service Manual contains troubleshooting steps for the ECG subsystem. These tests will help determine if the main board is faulty.

2.2.9 ECG Test:

Use a calibrated simulator to check performance.

NOTE: There is no calibration for the ECG or impedance Respiration subsystems.

If the performance does not match up to that expected using a calibrated simulator then there could be a problem with the cable, leads, connectors, wiring or the main board itself. If the main board is faulty then replace it.

SpO_2 Test

NOTE: There is no calibration for the SpO_2 and Pulse subsystem. If the performance does not match up to that expected using a calibrated simulator, or the Phantom finger set, then the subsystem board must be replaced.

2.2.10 SpO_2 Tests:

Need:

Appropriate Phantom finger set

SpO_2 cuff and cable

Or:

Nellcor or Nonin (as fitted) simulator (replaces cuff to drive subsystem)

Or:

Calibrated SpO_2 simulator that has a cuff fitting that simulates a perfused finger

Nonin: Settings for NoninPatient Simulator 8000S are 98% O_2 / 80 BPM. SpO_2 board accuracy after 25 second stabilization period must be within +/-2%O_2 and +/- 2BPM.

Nellcor: Settings for Nellcor Patient Simulator SRC-2 are 81% O_2 and 112 BPM. SpO_2 board accuracy after 25 second stabilization period must be within +/-2% O_2 and +/- 2 BPM.

Temperature Test

2.2.11 TEMP ACCURACY VERIFICATION

Need:

Calibrated thermometer (DIGITAL OR GLASS)

small insulated container with cover for warm water

2.2.11.1 Fill container wtih approximately 96 degree F water

2.2.11.2 Attach temperature probe neaqr the sensing part of the thermometer and insert into the warm water.

2.2.11.3 Accuracy must be within +/- 0.2 degrees F.

Description	Tool #	Company
Safety and Agency Test Equipment...SEE APPENDIX FOR LIST		
100cc Test Volume	T-112189	Welch Allyn
250cc Test Volume	T-112818	Welch Allyn
500cc Test Volume	T-112854	Welch Allyn
Bezel Tray (to protect front of Atlas during svc)	T-16424	Welch Allyn
Connector Separator Tool Deflection/Main boards	T-16654	Welch Allyn
Printer Connector Pliers	T-16673	Welch Allyn
Blood Pressure fitting Nut Driver	T-16593	Welch Allyn
Printer Motor Nut driver	T-16705	Welch Allyn
T-10 TORX screwdriver	XTD-10	Xcelite brand
7/16" deep socket for Temperature Port nut		generic 1/4" drive
Squeeze Bulb and Valve	5088-01	Welch Allyn
Calibrated Manometer (0-10PSIG)	31	Crystal Engineering
NeTech Manometer **PICK ONE MANOMETER**	200-2000IN	NeTech
Setra Manometer (0-10PSIG)	2270-01	Setra Systems
Pneumatic Tubing	97P24	Welch Allyn
Pneumatic Tubing (coiled)	5200-07	Welch Allyn
"T" Fitting (3)	5200-08	Welch Allyn
Nonin Patient Simulator	8000S	Nonin
Nonin Finger Phantom Calibration Kit	5200-53	Welch Allyn
Nonin Cable	5200-52	Nonin
Calibrated Thermometer for 90F to 115F range		
LG, Adult Cuff/Bag	5200-02	Welch Allyn
Inservice Training VideoTape (English/NTSC)	6200-44	Welch Allyn
Nellcor Patient Simulator	SRC-2	Nellcor
Nellcor Test Cable	EC-8	Nellcor
ECG Simulator	214B	DNI Nevada
ECG Patient Cable (5 lead AHA)	6200-02	Welch Allyn
ECG Patient Cable (5 lead domestic)	6200-04	Welch Allyn
ECG leads, 5 Lead (IEC)	6200-08	Welch Allyn
ECG leads, 5 Lead AHA	6200-06	Welch Allyn
Certified Tank approximately 10% CO2, balance N2		
ETCO2 Water Trap (package of 5)	6200-20	Welch Allyn
ETCO2 Scrubber	6200-21	Welch Allyn
ETCO2 Adult Nasal Sample Line	6200-22	Welch Allyn
Surface Sensor, Temperature	6200-15	Welch Allyn
Windows PC with HyperTerminal serialport software		Part of Windows 95&NT
8cond. cable w/connectors,RJ-45 to RJ-45	SPC 8461-0553	Newark 16N2497
Adaptor for cable above.DB-9 fem to 8 cond.RJ-45 fem	SPC 8588-0199	Newark 52N9489
Custom repair software: ATLASDOWNLOAD.EXE	Call	Welch Allyn
Printer Paper - Case	6200-40	Welch Allyn
Digital Multimeter with 10mV accuracy on a 10V scale; 10A Range		
Adjustable DC power supply 5A @ 7V		
Battery cable assembly	620174-1	Welch Allyn

Table 2-2:Software/Firmware revision levels

MODEL	Operating System	Boot loader	Nellcor	Nonin	Pryon
621SO	AA.01.4000, 9/8/99	AA.01.0000, 6/20/99		V7	
621SP	AA.01.4000, 9/8/99	AA.01.0000, 6/20/99		V7	
622SO	AA.01.4000, 9/8/99	AA.01.0000, 6/20/99		V7	
622SP	AA.01.4000, 9/8/99	AA.01.0000, 6/20/99		V7	
622NO	AA.01.4000, 9/8/99	AA.01.0000, 6/20/99	V 1.2.0.0 12/17/97		
622NP	AA.01.4000, 9/8/99	AA.01.0000, 6/20/99	V 1.2.0.0 12/17/97		
623SP	AA.01.4000, 9/8/99	AA.01.0000, 6/20/99		V7	0.E V1.00
623NP	AA.01.4000, 9/8/99	AA.01.0000, 6/20/99	V 1.2.0.0 12/17/97		0.E V1.00

2.3 Calibration

2.3.1 BP Calibration

Caution: Improper use, storage, handling of compressed gas vessels can cause injury or death! Follow gas manufacturers safety processes.

2.3.1 BP Calibration :

Need: 500cc vessel (approximate)
calibrated digital manometer
squeeze bulb with one-way valve
tubing and T fittings
PC with HyperTerminal *
serial cable

2.3.1.1 Connect: manometer, bulb, and 500cc vessel to BP port with "T" connectors, Atlas to PC with serial cable.

2.3.1.2 Turn AtlasON and start HyperTerminal on PC.

2.3.1.3 Enter commands on Serial interface:
Pangea> bp valve close<ENTER>
Pangea> bp safety off<ENTER>

2.3.1.4 Enter command:
Pangea> bp cal 5000
Do not press <ENTER> yet!

2.3.1.5 Raise pressure with bulb to as close to 50.00mmHg as possible or slightly higher. Let the pressure bleed down toexactly 50.00mmHg. Now press <ENTER> . Take no more than 3 minutes for this step.

2.3.1.6 Enter command:
Pangea> bp cal 25000<ENTER>

2.3.1.7 Repeat step 2.3.1.5 with 250.00 as target.
Press <ENTER> when pressure deteriorates to 250.00 mmHG.

2.3.1.8 Enter command:
Pangea> nvram write<ENTER>

2.3.1.9 Disconnect serial cable and instruments and cycle power on Atlas. BP cal complete.

2.3.1.10 Verify accuracy of pressure settings by repeating step 2.3.1.3 then 2.3.1.5 and compare Atlas front panel reading with Setra readout. Do this at 50.00mm and 250 mm Hg.

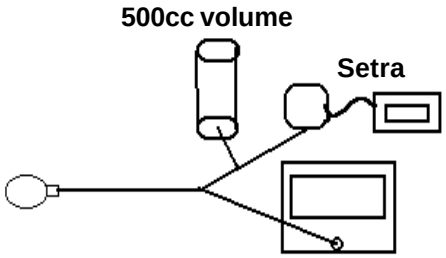


Figure 2.3.1.1

***Access and set up HyperTerminal:**
1-Start
2-Settings
3-Control Panel
4-Add/Remove Programs
5-Windows Setup
6-Communications
7-selectHyperTerminal
8-APPLY
Settings are:
9600 Baud, 8 bit word, 1 stop bit
no parity, no flow control
ANSI character set
Find HyperTerminal in Programs, Accessories

2.3.2 ET CO_2 Calibration

2.3.2 ET CO_2 Calibration: **623 Models only**

Need: Tank of approximately 10% CO_2, balance N_2 (certified) Blood Gas Mixture
Tubing and T connectors
Watertrap and scrubber

2.3.2.1 Insert water trap. Power up.

2.3.2.2 Place the instrument into Service Mode: Press Date/Time Lead Select button.

2.3.2.3 Select Calibrate CO_2
Message "**Remove CO_2 water trap**" will appear.

NOTE:Replace water trap every 6 hrs of use. Treat water trap and used NasalCO2 Sample lines as bio hazard material!

NOTE: The Scrubber looks similar to a watertrap, but is filled with white granules. It is included with model 623XX.

2.3.2.4 Remove water trap from water trap socket .
2.3.2.5 Message "**Install scrubber**" will appear .
2.3.2.6 Attach scrubber to water trap.
2.3.2.7 Insert scrubber/water trap assembly into water trap socket.
Message "**Enter span gas value using <Set> button**" will appear.
2.3.2.8 Change the default value (10%) to the value of span gas being used (calibrated 8% to 12% concentration known to ±0.01%).
2.3.2.9 Press <BP Start/Cancel>
Message: "**Sampling**" appears while the instrument is sampling the scrubber air.
2.3.2.10 When instructed, remove the scrubber from the CO_2 water trap. Do not remove water trap.
2.3.2.11 Attach the calibrated source of CO_2 gas to the CO_2 side-stream sampling tube as per Figure 2.3.2.11
2.3.2.12 Adjust the CO_2 regulator just enough to allow a small amount of gas to flow out of the vent (approximately 3 PSI).

Note: Adjust regulator to approximately 2 PSI.

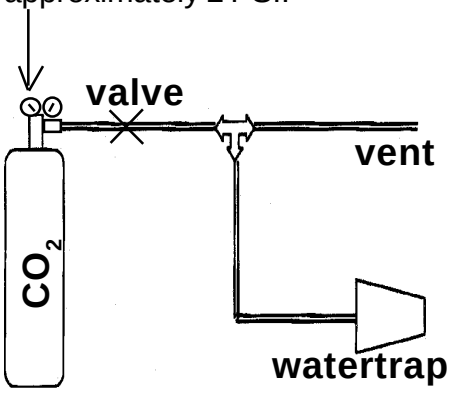


Figure 2.3.2.11

NOTE:Replace water trap every 6 hrs of use. Treat water trap and used NasalCO2 Sample lines as bio hazard material!

Important: Once positive flow is established, let the it flow for one minute before pressing the Continue button and actually sampling.
After one minute, press the Continue button to let the Atlas start sampling CO_2 .

2.3.2.13 Press <BP Start/Cancel>
Message: "**CO_2 calibration successful**" or "**CO_2 calibration failed**" will appear on the CRT display.

(Note: Serial Communication is not the cause of a failure if the Prion Serial appears in the Service Screen. Therefore the problem is with the board or connections and not serial communication problems.)

2.3.2.14 Press Trend button to Exit.

SR856: CO_2 Calibration beyond the year 2021

To calibrate the CO_2 system in years 2022 or later it is necessary to reset the system clock to an earlier year, perform the calibration, and then set the clock to the correct year again. The service center should keep a record of this since the **Cal** display in the Service Mode screen will be incorrect.

2.3.3 CO_2 RESET
Need: Watertrap and Scrubber

2.3.3.1 Press the Date/Time button on the lower right of the monitor. The Set Date and Time and Other Options menu will be displayed.

2.3.3.2 Select the Reset CO_2 selection by pressing the CO_2/RESP ALARMS Off button. CO_2 Reset screen will appear.

2.3.3.3 Follow the instructions on the screen. "Remove the CO_2 watertrap". "Install the CO_2 Scrubber onto the CO_2 watertrap."

NOTE: The Scrubber looks similar to a watertrap, but is filled with white granules. It is included with model 623XX.

2.3.3.4 Remove the tubing from the watertrap and attach the Scrubber to the watertrap.

2.3.3.5 Insert the watertrap/Scrubber combination into the watertrap socket.

2.3.3.6 Messages: The system will report that it is Sampling. The system will then report Reset Complete.

2.3.3.7 Remove the watertrap/Scrubber from the watertrap socket.

2.3.3.8 Detach the Scrubber from the watertrap and reattach the tubing.

2.3.3.9 Replace the watertrap in the watertrap socket.

2.3.3.10 Press Trend to return to the waveform screen.

2.3.3 CO_2 RESET

NOTE: There may be a message indicating a 5 minute Warming Up period.

2.3.4 PRINTER CALIBRATION

Note: Two lines are displayed: Waveform +128, Text +70
These two numbers are factory defaults and a good starting point if the system is printing very poorly or not at all.
The LEFT<SET> button controls the Waveform setting, up and down. The RIGHT <SET> button controls the Text setting, up and down. Make changes tothe settings as needed, where a larger number = darker printing and a smaller number = lighter printing. Make initial changes of about 10 points each time. After making an adjustment, press <TREND> to exit the Service Mode.

2.3.4 PRINTER CALIBRATION

Need:
PC with HyperTerminal
Serial cable
Connector

2.3.4.1 Use HyperTerminal to get strobe width settings for printer normal for waveforms - text for trend

Advanced configuration printing:

Pangea> nvram get printer_strobe_width_normal<ENT>
(normal value 130)

Pangea> nvram get printer_strobe_width_text <ENT>
(normal value 70)

2.3.4.2 Change values - larger number for darker printing. Change with:

Pangea> nvram set printer_strobe_width_normal XXX
Pangea> nvram set printer_strobe_width_text YYY

2.3.4.3 Test and reset until satisfied.
2.3.4.4 Press Trend button to exit the Service Mode.

2.3.5 BATTERY VOLTAGE CALIBRATION

2.3.5 BATTERY VOLTAGE CALIBRATION for models 622XX and 623XX.

NOTE: CHECK BATTERY VOLTAGE CALIBRATION AFTER REPLACING MAIN PCB.

Need:
DC power supply rated: 7 VDC at 5A
Battery eliminator cable - Atlas battery plug on one end, interface to the power supply on the other. There should be access for voltmeter probes at the Atlas end of the cable when it is installed
DMM / DVM with 10mV resolution on a 10V scale
PC with HyperTerminal
Serial cable and connector

2.3.5.1. Connect serial cable to PC and Atlas
2.3.5.2 Remove battery from Atlas
2.3.5.3 Set the power supply to 6.8V +/- 200mV
2.3.5.4 Connect the power supply to the Atlas battery connector.
2.3.5.5 Turn Atlas ON.
2.3.5.6 Reduce the power supply to 6.0V

2.3.5.7 Measure the voltage at the battery connector (at the Atlas) to the nearest 10mV.

NOTE: Do not measure at the power supply, since cable resistance will introduce error.

2.3.5.8 At the HyperTerminal, type:
Pangea> power cal XXXX<ENTER>
(where XXXX represents the measured voltage in millivolts no decimal point.) For example, if you measured 6.010V at the battery connector, use the command "power cal 6010<ENTER>".

2.3.5.8 The Atlas will respond:
raw = ZZZZ mV true = 6010 mV OK
(where ZZZZ is the raw uncalibrated reading that the instrument made.)

2.3.5.9 Reduce the power supply to 5.6 volts. You should soon hear the "low battery" alarm.
2.3.5.10 Measure the voltage at the battery connector to the nearest 10mV.
2.3.5.11 At the HyperTerminal, type:
Pangea> power cal XXXX<ENTER>
(where XXXX represents the measured voltage in millivolts no decimal point.) For example, if you measured 5.590V at the battery connector, use the command "power cal 5590<ENTER>".

2.3.5.12 The Atlas will respond:
raw = ZZZZ mV true = 5590 mV OK

(where ZZZZ is the raw uncalibrated reading that the instrument made.)

2.3.5.13 Finish by typing: (this will re-boot ATLAS)
Pangea> hw reset<ENTER>
2.3.5.14 Turn Atlas OFF and remove the power supply.
2.3.5.15 Re-Install the battery.

2.3.6 TEMPERATURE MEASUREMENT SUBSYSTEM CALIBRATION

2.3.6 TEMPERATURE MEASUREMENT SUBSYSTEM CALIBRATION:

Need:
PC
Serial Cable
HyperTerminal
1kOhm - 2kOhm 1% 1/2watt resistor
Large RCA plug (1/4") 2 conductor
Short length of wire (optional)
Soldering iron and solder

2.3.6.1 Prepare Resistor/Plug assembly.
Solder the resistor across RCA plug terminals.

2.3.6.2 Plug the resistor assembly into the Atlas Temperature jack.
2.3.6.3 Connect the Atlas to the PC serial port.
2.3.6.4 Turn the Atlas ON.

NOTE: Temperature display will show a valid temperature.

2.3.6.5 Start HyperTerminal on the PC.
2.3.6.6 At the Pangea prompt, type:
Pangea>temp cal xxxxxx<ENTER>

(where the xxxxxx is the value of the precision resistor in centiOhms- Specify the Ohms, tenths, and hundredths of Ohms with no decimal point- for example, a 1200.00 Ohm resistor would be: Pangea>temp cal 120000<ENTER>

2.3.6.7 Wait four seconds then type:
Pangea>temp state<ENTER>
2.3.6.8 Displayed resistance will be within 0.5 Ohms of the value that you entered.
The Offset should not exceed 5.0 Ohms.

NOTE: The system will silently fail (without error) if it is unable to calibrate properly. Therefore you must manually verify that this resistance is correct.

2.3.6.9 Turn the Atlas OFF.
2.3.6.10 Unplug the resistor/plug assembly.
2.3.6.11 Remove the serial cable.
2.3.6.12 Check the accuracy of the temperature sensing system using the process described in Section 2.2.11

2.3.7 Set battery charging voltage:
Specification :No Load: 6.85VDC
Need: DVMM
2.3.7.1 Remove battery from unit and unplug.
2.3.7.2 Use DVMM to check across right pin (+) and left pin (-) when viewed looking into the battery compartment.
2.3.7.3 Adjust potentiometer R338 to obtain 6.85VDC. (It is located at the right of the battery jack.
Turn it counterclockwise to increase the charging voltage.

2.3.7 Set Battery Charge Voltage

X4	Situation	Condition	Action	Details	Advanced Configuration (user set preferences using front panel controls	Initialize NVRAM using hyperterminal	Download operating system using windows	ReCalibrat Atlas? (BP, Power, temperature and not CO_2)	Sequence
1	A1 Software Updgrade	B1 Unit has no problems	C1 Use the new download utility "atlas_dl.exe"	D1 HyperTerminal not required.	E1 **YES** "atlas_dl.exe" loads nvram_common.txt file which overwrites all previous settings with defaults. After repair, please check all user preference settings (Advanced Configuration Menu) and ALARM settings and set them the way the unit was received.	F1 **NO**	G1 **YES** software information resides in CPU	H1 **NO** With atlas_dl.exe program the calibration constants are not changed.	I1 1. Run atlas_dl.exe 2. Check alarm settings and other consumer preference advanced configuration settings.
2	A2 Main board failed	B2 Just replacing Main board. The original CPU board is OK.	C2 Replace Main board, initialize nvram, and recalibrate.	D2 Need HyperTerminal for setting nvram and calibration.	E2 **Yes..Same as above**	F2 **YES**	G2 **NO:** operating system resides in CPU which was untouched.	H2 **YES** the NVRAM of the new main board will not have the correct calibration constants.	I2 1-Set NVRAM 2-Recalibrate 3-Check alarm settings
3	A3 CPU board failed	B3 Just replacing CPU board. The original Main board is OK.	C3 Replace CPU board and load operating system.	D3 Need atlas_dl.exe file	E3 **Yes..Same as above**	F3 **NO**	G3 **YES** software information resides in CPU	H3 **NO**	I3 1-download operating system 2-Check alarm settings and other consumer preference advanced configuration settings
4	A4 Both CPU and main board failed	B4 Replacing both the CPU and Main boards.	C4 Replace both boards, use atlas_dl.exe, reconfigure, calibrate.	D4 Need HyperTerminal for setting nvram and calibration.	E4 **Yes..Same as above**	F4 **YES**	G4 **YES** software information resides in CPU	H4 **YES** the NVRAM of the new main board will not have the correct calibration constants.	I4 1-Run atlas_dl.exe 2-Set nvram 3-Recalibrate 4-Check/set alarm settings

2.4 Downloading Operating System

When required: to load latest revision software* on a fully functioning Atlas or to reload software after replacing the MCU board. The atlas_dl.exe program loads the following files:

atlas.out.gz
nvram_common.txt
nvram_(model#).txt **
nvram_(language).txt **

Equipment or supplies required:
PC with Windows '95/NT
Serial cable with connector: (COM1to PC)
File : atlas_dl.exe

2.4.1 Connect serial cable between Atlas and PC COM1
2.4.2 Double click "atlas_dl.exe" explorer window
2.4.3 After downloading is complete, check alarm and other User controlled advanced configuration settings since these are 'reset' by this downloading process.

Downloading Operating System complete

2.4 Downloading Operating System
(when upgrading software or replacing CPU board)

****Note: Hyperterminal queries the Atlas to determine which model number and language to download.**

Note: If Atlas calibration was satisfactory prior to downloading software then recalibration is not required.

2.5 Downloading NVRAM files with Hyperterminal*.

The NVRAM resides on Main Board. Hyper terminal loads the following files:

cal_init.txt
common.txt
(model#).txt **
(language).txt,**
printer.txt (if required),
or no_printer.txt.

2.5.1 Connect serial cable between Atlas and PC COM1 as in 2.4 above.
2.5.2 Open HyperTerminal program on PC:
START
PROGRAMS
ACCESSORIES
HYPERTERMINAL
2.5.3 Turn Atlas ON. You should see some version information and a prompt:
Pangea>
2.5.4 Transfer Text files:
(TRANSFER/SEND TEXT FILE)
NVRAM_CAL_INIT.TXT (only if main board has been replaced)

2.5 Downloading NVRAM Text files
after replacing Main Board

*Configure HyperTerminal
9600 Baud
8 bits
1 stop bit
no parity
no flow control

2.5 Downloading NVRAM Text files
when replacing Main Board continued

NVRAM_COMMON.TXT
NVRAM_NO_PRINTER.TXT
or
NVRAM_PRINTER.TXT
NVRAM_(model 200,210,220).TXT
NVRAM_<LANGUAGE>.TXT

2.5.5 After these text files are transferred, Type the following serial commands to update the serial number:

nvram set serial___ (last 3 digits of serial#)
nvram write
hw reset (hardware reset restarts Atlas and saves the new settings)

2.5.6 Verify the serial number correct

2.5.7 Recalibrate Atlas unit. After calibration is complete.

2.5.8 Check alarm settings and User selected advanced Configurations

2.6 Downloading Software & NVRAM Text files
after replacing Main Board AND CPU board

2.6 Downloading Software & NVRAM Text files

2.6.1 Use atlas_dl.exe as in step 2.4. to Program new CPU board.

2.6.2 Use HyperTerminal as in step 2.5 to set NVRAM on new Main Board.

2.6.3 Recalibrate Atlas

2.6.4 Check alarm settings and User selected advanced Configurations

NOTE: Firmware Download
Software versions of OEM boards are not field upgradeable. (SpO_2 boards or the CO_2 board.) Replace the subsystem board with a higher (current) version if necessary.

2.7 Product Model Number Structure

621S0* ECG, Nonin SpO_2, NIBP

621SP* ECG, Nonin SpO_2, NIBP, Printer

622S0** ECG, Nonin SpO_2, NIBP, Temp, Respiration, Battery, RS232, Nurse Call

622SP** ECG, Nonin SpO_2, NIBP, Temp, Respiration, Battery, RS232, Printer, Nurse Call

622N0** ECG, Nellcor SpO_2, NIBP, Temp, Respiration, Battery, RS232, Nurse Call

622NP** ECG, Nellcor SpO_2, NIBP, Temp, Respiration, Battery, RS232, Printer, Nurse Call

623SP** ECG, Nonin SpO_2, NIBP, $ETCO_2$, Temp, Respiration, Battery, RS232, Printer, Nurse Call

623NP** ECG, Nellcor SpO_2, NIBP, $ETCO_2$, Temp, Respiration, Battery, RS232, Printer, Nurse Call

SUFFIX:

Use letter designation for language localization as follows:
E = English, F= French, G= German, I= Italian, S= Spanish, P= Portuguese C = Chinese, J= Japanese

Use number designation for line cord localization as follows:

1 = US, Canada, Japan Version
2 = European Version
4 = United Kingdom Version
6 = Australian Version

Specifications: See Operator Manual

Specifications for all of the above listed models of Atlas including performance, accuracy, range, size, weight, power, environmental, are documented in an appendix to the User Manual.

*** Model 200 Main Board and Schematic 200**
**** Model 220 Main Board and Schematic 220**

3.1 Functional Test and Initial Diagnostic

1. **Review customer complaint and determine if it is safe to plug in and turn on Atlas**
2. Plug in Atlas, no sensors attached.
3. Check for **AC~** LED lit.
4. Install paper in printer if fitted.

5. **Turn on power**
6. Green light in power button.
7. Loud beep when button pressed.
8. Three dashes in SYSTOLIC.
9. Three dashes in DIASTOLIC.
10. Two dashes in SpO_2 (takes several seconds after BP dashes come on).
11. Three dashes in PULSE (takes several seconds after BP dashes come on).
12. Pleth: none, or a single bar at the bottom, or two bars at the bottom.
13. No lights in TEMP.
14. No lights in ALARMS OFF buttons.
15. X lit on AUTO.
16. AC~ lit
17. CRT display comes on slowly if cold, quickly if still warm from last use.
18. May see version string in center if comes on quickly, not a problem if not seen because it comes on slowly.
19. CRT: three dashes for Heart Rate
20. Heart picture
21. Lead select symbol
22. Scale bar
23. One or two lines of dashes for waveforms – depends upon settings.
24. Three dashes for MAP – or blank, depends upon settings.
25. Error message(s) at bottom of screen?

26. If 622 or 623, pull AC cable. Should be no change except AC~ unlit.
    - 26.1. If errors of low, very low or depleted battery, or if system dies, plug back in and repeat test in 2 hours.

Note: “Idle” screen is normal waveform display.

MENU TESTS

Plug AC back in.

27. Press <DATE/TIME><TREND>
28. Get Advanced Configuration menu.
29. Write down all settings for resetting to customer preference later.
30. **Set language to your native tongue if necessary to allow you to write down the other settings**. The top item is always the language, press either <SET> button to step through list.
31. Press <PRINT> if printer fitted.
32. Press <TREND> to return to idle screen.

33. Press <DATE/TIME>
34. Get date/time menu.
35. Verify date/time, set if necessary.
    - 35.1. Bad date may indicate battery problem. If date was bad, turn off unit, pull power cable, wait 5 minutes reconnect power cable, turn on unit. Check date again.
      - 35.1.1. If date comes back bad: Replace main board Model 200. Model 210, 220, if battery not dead replace main board.

Press Date/Time to return to waveform screen if needed.

36. Press <DATE/TIME><LEAD SELECT>
37. Get Service Mode menu.
38. Examine version/configuration data in lower half of menu, and **write it all down.**
39. Press <SELECT> to highlight **Reset to factory defaults.**
40. Press <BP START/CANCEL> to reset configuration.
41. Press <TREND> to return to idle screen.
42. Press <DATE/TIME><TREND>
43. Get Advanced Configuration menu.
44. **Set language to your native tongue if necessary**
    - 44.1. We have just reset to **factory defaults**. Compare settings to factory defaults appropriate for the country – in Operator manual. If not matching, indicates memory problems. Changing only the language should not change any of the other factory default settings.

45. Press <DATE/TIME><LEAD SELECT>

46. Get Service Mode menu.
47. Press <Select> to highlight **CRT test pattern.**
48. Press <BP START/CANCEL> to show test pattern. Examine display.
49. Press any key to end display.

50. Press <Select> to highlight **Printer test pattern** (if fitted).
51. Press <BP START/CANCEL> to start test pattern.
52. Printer should print test pattern.
53. Press any key to end display.
54. Examine printout.

55. Press <Select> to highlight **LED test** .
56. Press <AUTO> to turn on all LEDs .
57. Press <BP START/CANCEL> to show automatic test pattern.
58. Watch for a while, look for glitches in pattern.
59. Press <Set> to go to manual mode and step through individual segments if needed to observe a problem.

60. Press <Select> to highlight **Button test.**
61. Press <BP START/CANCEL> to start test.
62. Press every button on system, <BP START/CANCEL> last.
    - 62.1. Verify that buttons match up with their names, and that all buttons are functional.
      - 62.1.1. If names don't match, indicates memory corruption: Replace main board

63. Press <Select> to highlight **Display A/D channels** (three or four screens worth)
    - **63.1. Write down all values for later review.**
    - 63.2. Press <Set> and write down all values for each screen.
64. Press <Trend> to return to Idle screen.

BP test

65. Connect the BP port to the BP simulator.
66. Set the simulator for a normal reading (140/80, 100BPM, NSR).
67. Press <BP START/CANCEL>
    - 67.1. System should start pump, display manometer value in SYSTOLIC LED; this value should track and be very close to pressure

displayed by manometer in BP simulator (if fitted). Largest number shown in SYSTOLIC should be very close to the **Initial pressure** setting recorded above from Advanced Configuration.

67.2. System should step down pressure, showing step values in SYSTOLIC LED, and then display correct SYSTOLIC and DIASTOLIC values. System may show MAP value depending upon country.

68. Press <DATE/TIME><TREND> to get to Advanced Configuration menu.
69. Press <Select> to highlight **Initial pressure.**
70. Press <Set> to change **Initial pressure** to 280 mmHg.
71. Press <Select> to highlight **MAP.**
72. Press <Set> to change **MAP** to **Yes.**
73. Press <TREND> to return to idle screen.

74. Press <BP START/CANCEL>
75. System should start pump, display manometer value in SYSTOLIC LED; this value should track and be very close to pressure displayed by manometer in BP simulator (if fitted). Largest number shown in SYSTOLIC should be very close to the **Initial pressure** setting of 280 mmHg.
    75.1. If pressure shown exceeds 300 mmHg: Recalibrate BP

76. System should step down pressure, showing step values in SYSTOLIC LED, and then display correct SYSTOLIC and DIASTOLIC values. System should show MAP value. MAP value should match what is shown by simulator.

77. Set simulator to highest Systolic <=250, lowest Diastolic >= 30, and lowest heart rate >=30.
78. Press <AUTO>
79. X goes unlit, 1 flashes for 10 seconds.
80. 20 seconds after 1 stops flashing, BP measurement starts.
81. BP reading as above.
    81.1. If BP does not start: Replace main board
    81.2. If BP measurement incorrect recalibrate

82. No less than 30 seconds after completing the measurement another measurement should start. While it is pumping up, press <BP START/CANCEL>. Measurement stops immediately and pressure is dumped (as seen on manometer on simulator).
    - 82.1. If measurement does not stop immediately: Main board or button.
    - 82.2. If pressure does not drop below 10mmHg immediately: Main board

83. Press <AUTO> and X lights up (not flashing).

84. Disconnect the tubing from the BP port on the Atlas.
85. Press <BP START/CANCEL> and note the time (to the second).
86. The BP should abort with an alarm after no longer than one minute.

ECG

Note: Simulator must support impedance respirator.

87. Cycle power on Atlas, connect a 5 lead cable set to the simulator.
88. Configure the simulator for NSR 100BPM and Impedance Respiration.
89. Plug the cable into Atlas.
90. Press <DATE/TIME> <TREND> to access Advanced Configuration menu.
91. Press <Select> to highlight **ECG lead set** and press <Set> to select **5 wire.**
92. Set **ECG gain** to **Automatic.**
93. Set **ECG speed** to **25mm/s.**
94. Set **ECG bandwidth** to **Monitor.**
95. Set **Second trace selection** to **ECG.**

Press <TREND> to return to idle screen
Should see:

- 95.1. ECG cascading onto second line
- 95.2. Scale bar on left of top line
- 95.3. Heart rate displayed as set on simulator
- 95.4. Lead Selected = II
- 95.5. Pulse tone high pitched

Press <LEAD SELECT> and step through each of the lead settings.
Should see:

- 95.6. Different looking ECG waveforms
- 95.7. Heart Rate will go to dashes and alarms on some leads

96. Set lead selected to II

97. Press <DATE/TIME><TREND> to access Advanced Configuration menu.
98. Change **Second trace selection** to **Respiration.**
99. Press <TREND> to return to idle screen.
100. Should see:
    - 100.1. ECG on top line
    - 100.2. Scale bar on left of top line
    - 100.3. Heart rate displayed as set on simulator
    - 100.4. Lead Selected = II
    - 100.5. Pulse tone high pitched
    - 100.6. Respiration trace on second line
    - 100.7. Respiration rate displayed as set on simulator.
101. Disconnect ECG simulator

SpO_2

102. Connect SpO_2 cable and cuff and install cuff on simulator (or your finger).
103. Set simulator to normal readings.
104. See pleth signals immediately.
105. See SpO_2 percentage within several seconds .
106. See Pulse display at the same time as SpO_2 percentage.

107. Disconnect SpO_2 cuff from simulator.
108. See error "SpO_2 cuff not detected".

109. Unplug SpO_2 cable from Atlas.
110. See error "SpO_2 cable not detected".

Temp

111. Temp display is blank.
112. Connect temp probe.
113. See temp display of ambient temperature.

114. Disconnect temp probe.
115. Temp display becomes dashes. No alarm or error

CO_2

116. Press <DATE/TIME><TREND>
117. Get Advanced Configuration menu.
118. Set **Second trace selection** to **CO_2.**
119. Press <TREND> to return to idle screen.
120. Insert watertrap with tubing attached.
121. Should see:
    - 121.1. Hear pump motor start.
    - 121.2. See solid line waveform on lower trace.
    - 121.3. See dashes in Respiration Rate.
    - 121.4. See dashes in mmHg (or % or kPa, as configured).

122. Breathe gently and repeatedly over end of tubing
123. Should see:
    123.1. See waveform within seconds of breathing
    123.2. See respiration rate non zero within one minute.
    123.3. See CO_2 concentration non zero within one minute.

BATTERY

124. System must have been plugged in for 24 hours for a real battery test to guarantee that battery is fully charged, but for functional test we can try it:
125. Press <DATE/TIME><LEAD SELECT>
126. Get Service Mode menu
127. Press <SELECT> to highlight **Battery test**
128. The menu reports
    Battery Low Time XXX and
    Battery Dead Time YYY
    These are the results from the last battery test. The Battery Low Time is the time in hours and minutes that the battery ran in the last test until the Low Battery alarm started, and the Battery Dead Time is the time from the beginning of the Low Battery Alarm until the system turned itself off when the battery voltage reached the cutoff level.

Note: 2:08 means 128 minutes which is the default setting indicating a battery test has never been made before.

129. Write down the Battery Low Time and Battery Dead Time
130. Unplug AC cord to start battery test
131. The timers will begin. Leave the system until it powers down. Plug in AC and turn the system on, enter the Service Mode menu, select Battery Test again, and write down the new values. Compare these to the previous values, and to the minimum specification: Battery Low Time = 1 Hour
    Battery Dead Time = 10 Minute minimums.
132. Replace the battery if performance falls below specification

NOTE: Configuration settings for printing are different for text pages (Advanced Configuration and Trend displays) and for waveforms.

PRINTER

133. Connect ECG simulator to generate a sample waveform.

134. Press <PRINT> and look at waveform printout. Look for darkness, thickness of lines, legibility of text, blurring, “blooming” of text.

135. Press <DATE/TIME><TREND>
136. Get Advanced Configuration menu.
137. Press <PRINT> and look at text printout.

137.1. If feeding problems: Mechanical inspection of printer, replace motor, drive platten.
137.2. If waveforms too light or dark: Calibrate
137.3. If text too light or dark in configuration screen, press <Select> until “Printer test pattern” is highlighted then press <HR Alarms Off> button, then press <Set> to lighten or darken print.
137.4. If incorrect printout, missing elements, miss ing grid, etc: Troubleshoot further

Software/firmware

138. Review versions written down earlier and compare to latest available, and also make sure that all components are compatible with each other. See table 2.6 in this document.

ALARMS/SOUNDS

Power-on beep

139. Turn off system, and turn on. Should hear loud Power-on beep.

ECG pulse tone, pulse volume control, saving settings, <HR ALARMS Off> button

140. Connect ECG simulator.
141. Should hear: heart rate beep, at constant high pitch
142. Press SpO_2 volume button “-“ 8 times. Should get quieter and finally silent.

143. Press <DATE/TIME><PRINT> to **Save settings**.
144. Turn system off and back on.
145. Pulse tone should be silent even though heart rate is shown.

146. Press SpO_2 volume button “+” 8 times. Should get audible and then louder.

147. Disconnect ECG cable

148. Should hear Technical alarm and see error message.
149. Press <HR ALARMS Off> button.
150. Should stop Technical alarm sound, and erase error message, and light LED in <HR ALARMS OFF> button.
151. Press <HR ALARMS OFF> button again.
152. Should hear Technical alarm sound, see error message, LED unlit in <HR ALARMS Off> button.
153. Turn system off and on.

SpO_2 pulse tone

154. Attach SpO_2 cable and cuff, and attach to simulator or finger.
155. Should hear heart rate beep, different tone than when ECG was connected.
156. Change SpO_2 setting on simulator, or hyperventilating, hold breath, should hear tone pitch change up or down tracking simulator setting.

Limit Alarm, alarm volume control, Silence button, Technical Alarm, <SpO_2 ALARMS Off> button

157. Press right <Select> button until **SpO_2 LO** is flashing, press right <Set> UP to change SpO_2 LO setting to 99.
158. Wait until SpO_2 LO stops flashing.
159. Set simulator to SpO_2 at 90%.
160. Should hear Limit alarm.

161. Press <Alarm Volume> "-" eight times. Should get quieter but not silent.
162. Press <Alarm Volume> "+" eight times. Should get louder.

163. Press <Silence> and start stopwatch. Should be quiet for the time set in Advanced Configuration menu, then alarm comes back on.

164. Disconnect SpO_2 cable from Atlas.
165. Should hear technical alarm, see error message "SpO_2 cable not detected"
166. Press <SpO_2 ALARMS Off> button.
167. Should stop Technical alarm sound, and erase error message, and light LED in <SpO_2 ALARMS OFF> button.
168. Press <SpO_2 ALARMS OFF> button again
169. Should hear Technical alarm sound, see error message, LED unlit in <SPO_2 ALARMS Off> button.
170. Turn system off and back on.

<CO_2/RESP ALARMS Off> button

171. Press <DATE/TIME><TREND>
172. Get Advanced Configuration menu
173. Set **Second trace selection** to **CO_2**
174. Press <TREND> to return to idle screen
175. Insert CO_2 watertrap with hose
176. Breath into hose until waveform is displayed
177. Remove CO_2 watertrap
178. Should hear Technical alarm and see error message. - "CO_2 watertrap not detected"
179. Press <CO_2/RESP ALARMS Off> button.
180. Should stop Technical alarm sound, and erase error message, and light LED in <CO_2/RESP ALARMS OFF> button.
181. Press <CO_2/RESP ALARMS OFF> button again.
182. Should hear Technical alarm sound, see error message, LED unlit in <CO_2/RESP ALARMS Off> button.
183. Turn system off and back on

<BP ALARMS Off> button

184. With no hose connected to BP port, press <BP START/CANCEL> button
185. Place finger over BP port, blocking flow, causing BP to detect overpressure and abort
186. Should hear Technical alarm and see error message. - "Check blood pressure cuff"*
187. Press <BP ALARMS Off> button.
188. Should stop Technical alarm sound, and erase error message, and light LED in <BP ALARMS OFF> button.
189. Press <BP ALARMS OFF> button again.
190. Should hear Technical alarm sound, see error message*, LED unlit in <BP ALARMS Off> button.
191. Turn system off and back on.

Battery tone

192. Disconnect AC power on running system.
193. Connect BP hose to simulator
194. Press <AUTO> to select 1 minute intervals
195. Wait for battery to run down. With fully charged battery, after no less than 50 minutes, should hear single tone, get message that system will shut down in 10 minutes.

196. Should hear tone again in two minutes, and again two minutes after that.
197. Five minutes after first message, should start hearing tone every minute, and get message that 5 minutes remain until shutdown.
198. Ten minutes after first message, should hear technical alarm, see a printout of Trend data if there is any unprinted trend data accumulated, (which there is, we have been running BP measurements) and error message that system shutdown is imminent.

SELF DIAGNOSTIC ERROR MESSAGES

All the possible error messages are documented in an appendix to the Operator's Manual.

Complaint	Cause	Corrective Action
Power		
Will not power up in AC	No wall power Wrong wall power voltage/frequency Fuse in power supply Fuse in neutral wire Power supply failure	
LEDs		
Random LSD segments unlit Subsystem LEDs unlit LED intermittent, dim, flickering	Failed LED Subsystem problem Failed LED	LED 1 Check subsystem LED 1 Replace Display board
Buttons		
Button not functional Button sticking under front bezel Button intermittent or difficult to make contact	Failed switch Failed subsystem Possible loose display board Failed switch	Button 1 Check subsystem Tight display board mounting screws. Button 1
sounds		
No sound at all	Failed speaker or disconnected Failed main board Software corruption	Reload software sound 1
Battery		
Insufficient life	Failing battery	Battery 1
Printer		
Feed problems Waveform print quality Text print quality Not functional Feeding but not printing	Paper inserted incorrectly Door not latched Failed printer Software adjustment needed Software adjustment needed Failed printer Printer cable Paper inserted backwards Wrong kind of paper Failed printer	Printer 1 Printer 1 Printer 1 Printer 1 Printer 1
CRT		
CRT is blank	CRT cables Failed CRT Failed Deflection board Failed Main Board	CRT 1 Reinstall software

Complaint	Cause	Corrective Action
ECG		
ECG waveform not displayed (dashed lines)	Patient electrodes Lead wires Cable ECG cable connection Failed main board	ECG 1
ECG waveform not properly scaled	Possible patient physiology problem ECG gain set to 10mm/mV in Advanced Configuration	Check gain setting Reinstall software ECG 1
ECG waveform not cascading	Incorrect Advanced Cofiguration setting	Change Advanced Configuration setting to: Second trace source = ECG; ECG gain = automatic
Heart rate not detected	Patient electrodes Lead wires Cable ECG cable connection Failed main board Possible patient physiology problem Patient with Pacemaker?	ECG 1
Heart rate disagrees with Pulse rate	Possible patient physiology problem Patient with Pacemaker?	Repeat on another patient ECG 1 SPO_2 1 Compare manual palpation Reinstall software
Heart rate disagrees with manual palpation	Possible patient physiology problem	Does patient have abnormal ECG? Repeat on another patient ECG 1
SPO_2		
$Sp0_2$ displays not active	Incorrect brand sensor Failes $Sp0_2$ board Failes $Sp0_2$ sensor	SPO_2 1
$Sp0_2$ displays inaccurate	Possible patient physiology problem	$Sp0_2$ 1
Impedance Respiration		
IR waveform not displayed (dashes)	Possible patient physiology problem Poor signal LA/RA placement	ECG 1 Use modified electrode placement on chest walls

Complaint	Cause	Corrective Action
BP		
BP measurements inaccurate	Incorrect cuff size Incorrect cuff placement Possible patient physiology problem Calibration needed Pressure leak	Try different cuff - refer to Operator Manual for sizing information and proper cuff placement. Calibrate BP1
BP not working		BP1
Auto not working		BP1, Button 1
Cuff pressure too high		BP1, Calibrate
Cuff Pressure too low		BP1, Calibrate
Cannot take reading in time	Incorrect cuff size Incorrect cuff placement Patient movement Possible patient physiology problem Calibration needed Pressure leak	Try different cuff - refer to Operator Manual for sizing information and proper cuff placement. Calibrate BP1
Cannot achieve target pressure	Calibration needed Initial pressure set too low for patient physiology	Calibrate BP1
Hold pressure too long	Software problem Valve problem	BP1 Reload Software Replace main board
Dumps pressure while inflating	Software problem Valve problem Hardware sensor problem	BP1 Reload Software Replace main board
TEMP		
Readings inaccurate	Incorrect probe placement Possible patient physiology problem Poor physical contact with patient Excess aiflow, sunlight on probe Failed probe	See Probe insert material Use gel, adhesive tape to improve contact Protect probe from light, airflow Temp 1
Cannot read -wrong language	Language set wrong	Top entry is always language. Step through choices with <SET> button while top item is hightlighted
Nurse Call		
Does not work Intermittent signal	Relay failure Cable Cable connection	Connect Ohmmeter across pins 1 and 8. Expect infinity. Force an alarm state and expect 0 Ohms.
Brief signals	Battery tone errors Battery warnings will signal Nurse Call for only a second , every minute or two	Connect AC

Remove all instrument cables and hoses
Install printer paper if printer is fitted

Review customer complaint and determine if it is safe to plug in and turn on Atlas

If not safe to power up: smoke/flames/smell reported?

Goto Power 1

Check power available light
Goto Power 2

Check power-up state
Goto Power 3

Set language and Preserve customer settings
Goto Test Setup 1

Check date/time
Goto Test Setup 2

Reset to factory defaults
Goto Test Setup 3

Check software/firmware
Goto Test Setup 4

Check CRT Alignment Test
Goto CRT 1

Check Button Test
Goto Button 1

Check Display A/D Channels
Goto A/D 1

Check LED test
Goto LED 1

Check Printer alignment test
Goto Printer 1

Check Printer function
Goto Printer 2

3.3 TOP LEVEL TROUBLESHOOTING INDEX

3.3 TOP LEVEL TROUBLESHOOTING INDEX

Check Battery
Goto Battery 1

Check Alarms/Sounds
Goto Sound 1

Check BP
Goto BP 1

Check ECG
Goto ECG 1

Check SPO2
Goto SPO2 1

Check Temp
Goto Temp 1

Check CO2
Goto CO2 1

3.4 Diagnostic Tests

Power 1

Disassemble and inspect power supply, wires
Check fuse in power supply
Check fuse in neutral wire to power supply
Test power supply on bench
Check fuse in battery cable

Power 2

If AC~ not lit, check power cord continuity, outlet power available
Check connection at appliance inlet
Goto Power 1

Power 3

Turn on power
Green light in power button
    If not lit, goto LED 1

Loud beep when button pressed
    If not heard, goto Sound 1

Fan running (622xx and 623xx)
    If not running, goto Fan 1

Three dashes in SYSTOLIC
Three dashes in DIASTOLIC
    If not seen, goto LED 1
        If passed, goto BP 1

Two dashes in SPO2 (takes several seconds after BP dashes come on)
Three dashes in PULSE (takes several seconds after BP dashes come on)
Pleth: none, or a single bar at the bottom, or two bars at the bottom
    If not seen, goto LED1
        If passed, goto SPO2 1

No lights in TEMP (622xx and 623xx)
    If any are lit, goto Bad Boot 1

No lights in ALARMS OFF buttons
    If any are lit, goto Bad Boot 1

3.4 Diagnostic Tests

X lit on AUTO
    If not lit, or a number lit, goto Bad Boot 1

AC~ lit
    If not lit, goto LED 1

CRT display comes on slowly if cold, quickly if still warm from last use.
May see version string in center if comes on quickly, not a problem if not seen because it comes on slowly
CRT: three dashes for Heart Rate
Heart picture
Lead select symbol
Scale bar
One or two lines of dashes for waveforms – depends upon settings
Three dashes for MAP – or blank, depends upon settings.
    If not seen goto CRT 2

Error message(s) at bottom of screen?
    If message, review cause in User Guide

If 622xx or 623xx, pull AC cable. Should be no change except AC~ unlit.
    If system dies immediately, check fuse on battery cable
        If fuse is OK, either charge battery for 2+ hours or goto Battery 1
    If errors of low, very low or depleted battery, plug back in and repeat test in 2 hours

Test Setup 1

Press <DATE/TIME><TREND>
Get Advanced Configuration menu
Set language to your native tongue if necessary to allow you to write down the other settings. The top item is always the language, press either <SET> button to step through list.
Write down all settings for resetting to customer preference later
Press <PRINT> if printer fitted
    If printer problems, goto Printer 1
Press <TREND> to return to idle screen

3.4 Diagnostic Tests

Test Setup 2

Press <DATE/TIME>
Get date/time menu
Verify date/time, set if necessary.
    If date was significantly wrong, goto Date 1
Press <TREND> to return to idle screen

Test Setup 3

Press <DATE/TIME><LEAD SELECT>
Get Service Mode menu
Examine version/configuration data in lower half of menu, and **write it all down**
Press <SELECT> to highlight **Reset to factory defaults**
Press <BP START/CANCEL> to reset configuration
Press <TREND> to return to idle screen
Press <DATE/TIME><TREND>
Get Advanced Configuration menu
Set language to your native tongue if necessary
We have just reset to **factory defaults**. Compare settings to factory defaults appropriate for the country – in Operator manual if not here too.
    If not matching, goto NVRAM 1
Press <TREND> to return to idle screen

Test Setup 4

Compare version numbers from Test Setup 3 to table in Service Guide

CRT 1

Press <DATE/TIME><LEAD SELECT>
Get Service Mode menu
Press <SELECT> to highlight **CRT Test pattern**
Note screen alignment
    If misaligned, mechanical adjustment required on disassembled unit
Press <TREND> to return to idle screen

CRT 2

If no display at all on CRT:
    Check connections:
        CRT to Yoke cable
        CRT to Anode cable
        CRT to Deflection board
        Deflection board to Main board cable
    Replace CRT
    Replace Deflection board
    Replace Main board

3.4 Diagnostic Tests

If distorted display on CRT:

Check connections:

CRT to Yoke cable
CRT to Anode cable
CRT to Deflection board
Deflection board to Main board cable

Replace Deflection board
Replace CRT

If good display but some items are distorted or missing from CRT display:

If ECG waveform, heart rate, lead selected, heart symbol missing:

Replace Main board

Button 1

Press <DATE/TIME><LEAD SELECT>
Get Service Mode menu
Press <Select> to highlight **Button test**
Press <BP START/CANCEL> to start test
Press every button on system, <BP START/CANCEL> last
Verify that buttons match up with their names, and that all buttons are functional.

If a button does not report its name, goto Button 2
If a button reports the WRONG name, goto NVRAM 1

Press <Trend> to return to Idle screen

Button 2

If a single button does not report its name: Replace Display board
If multiple or all buttons do not report their names:

Check Display board to main board cable
Replace Display board
Re-install software
Replace CPU board
Replace Main board

3.4 Diagnostic Tests

A/D 1

Press <DATE/TIME><LEAD SELECT>
Get Service Mode menu
Press <Select> to highlight **Display A/D channels** (three or four screens worth)
Write down all values for later review
Need to provide tables of reasonable values, trouble-shooting pointers
Press <Set> and write down all values for each screen
    If data missing, corrupt or questionable, goto NVRAM 1 or Replace Display Board?
Press <Trend> to return to Idle screen

LED 1

Press <DATE/TIME><LEAD SELECT>
Get Service Mode menu
Press <Select> to highlight **LED test**
Press <AUTO> to turn on all LEDs
Press <BP START/CANCEL> to show automatic test pattern
Watch for a while, look for glitches in pattern
Press <Set> to go to manual mode and step through individual segments if needed to observe a problem
    If any failed LEDs, multiple segments lighting at once, or other problems: Replace Display Board
Press <Trend> to return to Idle screen

Printer 1

Press <DATE/TIME><LEAD SELECT>
Get Service Mode menu
Press <Select> to highlight **Printer test pattern** (if fitted)
Press <BP START/CANCEL> to start test pattern
Printer should print test pattern
Press any key to end printing
Examine printout
    If too dark/too light Goto Printer Settings 1 and Printer Settings 2
    If alignment errors: Adjust printer mechanism
    If feeding problems: Adjust printer mechanism, replace feed roller
    If missing sections/rows of printout: Replace Printer Hardware
    If darkness not consistent across page: Replace Printer Hardware

3.4 Diagnostic Tests

NOTE: Configuration settings for printing are different for text pages (Advanced Configuration and Trend displays) and for waveforms.

Printer 2

Connect ECG simulator to generate a sample waveform
Press <PRINT> and look at waveform printout. Look for darkness, thickness of lines, legibility of text, blurring, “blooming” of text

Press <DATE/TIME><TREND>
Get Advanced Configuration menu
Press <PRINT> and look at text printout.

If waveforms too light or dark: goto Printer Settings 1:
If text too light or dark: goto Printer Settings 2
If alignment errors: Adjust printer mechanism
If feeding problems: Adjust printer mechanism, replace feed roller
If incorrect printout, missing elements, missing grid, etc

Printer Settings 1

Connect serial cable between Atlas and PC
Start HyperTerminal on PC
At Pangea> prompt, type:
Pangea> *nvram get printer_strobe_width_normal<ENTER>*
Write down this value
If problem is that WAVEFORM printout is too light, increase this number. If the WAVEFORM printout is too dark, decrease this number.
Range is 0-256. Set new value with:
Pangea> *nvram set printer_strobe_width_normal XXX<ENTER>*
Pangea> *nvram write<ENTER>*
Where XXX is the new value.
Repeat the test that showed the problem.
Repeat this test-and-set process until ideal value is achieved
Disconnect serial cable

3.4 Diagnostic Tests

Printer Settings 2

Connect serial cable between Atlas and PC
Start HyperTerminal on PC
At Pangea> prompt, type:
Pangea> *nvram get printer_strobe_width_text<ENTER>*
Write down this value
If problem is that TEXT printout is too light, increase this number. If the TEXT printout is too dark, decrease this number.
Range is 0-256. Set new value with:
Pangea> *nvram set printer_strobe_width_text XXX<ENTER>*
Pangea> *nvram write<ENTER>*
Where XXX is the new value.
Repeat the test that showed the problem.
Repeat this test-and-set process until ideal value is achieved
Disconnect serial cable

Date 1

A bad date may indicate a battery problem. If date was bad, turn off unit, pull power cable, reconnect power cable, turn on unit. Check date again.

If date comes back bad:

Model 621xx: test/replace lithium on-board battery
Model 622xx/623xx: charge/test battery
If battery OK/Charged/Replaced repeat Test Setup 2
If still not maintaining date goto NVRAM 2

NVRAM 1

Failure to correctly reset factory defaults indicates memory problems. Changing only the language should not change any of the other factory default settings.
Reinstall software and repeat test.
If still failing
Replace CPU board

NVRAM 2

Date comes back wrong and battery already tested good
Reinstall software and repeat test
If still failing
Replace CPU board

NVRAM 2

Save Settings does not work
Reinstall software and repeat test
If still failing
Replace CPU board

3.4 Diagnostic Tests

Battery 1

System must have been plugged in for 24 hours for a real battery test to guarantee that battery is fully charged.
Press <BP Start/Cancel> to start a BP measurement; press <BP Start/Cancel> again after three seconds to abort the measurement – this puts an entry into the Trend list.
Press <DATE/TIME><LEAD SELECT>
Get Service Mode menu
Press <SELECT> to highlight **Battery test**
The menu reports:

Battery Low Time XXX and
Battery Dead Time YYY

These are the results from the last battery test. The Battery Low Time is the time in hours and minutes that the battery ran in the last test until the Low Battery alarm started, and the Battery Dead Time is the time from the beginning of the Low Battery Alarm until the system turned itself off when the battery voltage reached the cutoff level.
Write down the Battery Low Time and Battery Dead Time. Note that the value 2:08 is the default (128 minutes) and indicates that no test has been run before.
Unplug AC cord to start battery test.
The timers will begin.
Leave the system until it powers down.
One minute before power down, the system should print a Trend printout (if equipped with printer)

If Trend printout does not occur:

When system powers off, plug in AC and turn the system on.
Press <DATE/TIME><LEAD SELECT>
Get Service Mode menu
Press <SELECT> to highlight **Battery test**
The menu reports:

Low Time XXX and
Dead Time YYY

write down the new values. Compare these to the previous values, and to the minimum specification: Low Time >= 60 minutes; Dead Time >= 10 minutes
If either number is below specification, replace the battery

Sound 1

Power-on beep
Turn off system, and turn on. Should hear loud Power-on beep.

If beep not heard: Continue with this test. If no other sounds are heard, Replace Speaker Hardware.

3.4 Diagnostic Tests

ECG pulse tone, pulse volume control, saving settings, <HR ALARMS Off> button

Connect ECG simulator with a normal ECG setting.
Should hear: heart rate beep, at constant high pitch.

If heart rate beep not heard, press SPO2 volume button "+" three times

If heart rate beep still not heard:

If power-on beep was heard, *isolate to CPU/main board. Could also be display board with a bad button.*

Press SPO_2 volume button "-" 8 times. Should get quieter and finally silent.

If heart rate beep does not change volume: Replace Display Board

Press <DATE/TIME><PRINT> or <DATE/TIME> <FREEZE> to **Save settings**.
Turn system off and back on.
Heart rate beep should be silent even though heart rate is displayed.

If heart rate beep is not silent on power up: goto NVRAM3

Press SPO_2 volume button "+" 8 times. Pulse tone should get audible and then louder.

If heart rate beep does not change volume: Replace Display Board hardware

Disconnect ECG cable
Should hear Technical alarm and see error message.

If alarm not heard:

Press <HR ALARMS Off> button.
Should stop Technical alarm sound, erase error message, and light LED in <HR ALARMS OFF> button.

If alarm not silenced:
If error message not erased
If LED not lit:

Press <HR ALARMS OFF> button again.
Should hear Technical alarm sound, see error message, LED unlit in <HR ALARMS Off> button.

If alarm not heard:
If error message not displayed

3.4 Diagnostic Tests

If LED not unlit:
Turn system off and on to clear state.

SPO_2 pulse tone
Attach SPO2 cable and cuff, and attach to simulator.
Set simulator to normal heart and SPO_2 settings.
Should hear heart rate beep, different tone than when ECG was connected.
If heart rate beep not heard:

Change SPO_2 setting on simulator, should hear tone pitch change up or down tracking simulator setting.
If pitch does not change with simulator SPO2 percentage changes:

Limit Alarm, alarm volume control, Silence button, Technical Alarm, <SPO_2 ALARMS Off> button
Press right <Select> button until **SPO_2 LO** is flashing, press right <Set> UP to change SPO_2 LO setting to 99.
Wait until SPO_2 LO stops flashing (10 seconds).
Set simulator SPO_2 at 90%.
Should hear Limit alarm.
If alarm not heard:

Press <Alarm Volume> "-" eight times. Should get quieter but not silent.
If alarm volume does not change: Replace Display Board hardware.
If alarm volume goes all the way to silent: Replace display board.

Press <Alarm Volume> "+" eight times. Should get louder.
If alarm volume does not change: Replace Display Board hardware

Press <Silence> and start stopwatch. Should be quiet for the time set in Advanced Configuration menu, then alarm comes back on.
If alarm not silenced for set period:

Disconnect SPO_2 cable from Atlas.
Should hear technical alarm, see error message.
If alarm not heard:
If message not shown:

Press <SPO_2 ALARMS Off> button.
Should stop Technical alarm sound, and erase error mes-

3.4 Diagnostic Tests

sage, and light LED in <SPO_2 ALARMS OFF> button
If alarm not silenced:
If error message not erased
If LED not lit: Replace Display Board hardware

Press <SPO_2 ALARMS OFF> button again
Should hear Technical alarm sound, see error message, LED unlit in <SPO_2 ALARMS Off> button

Turn system off and back on to clear state.

<CO_2/RESP ALARMS Off> button
Press <DATE/TIME><TREND>
Get Advanced Configuration menu.
Set **Second trace selection** to **CO_2.**
Press <TREND> to return to idle screen.
Insert CO2 watertrap with hose.
Breath into hose until waveform is displayed.
If waveform not displayed after 30 seconds goto CO_2 1

Remove CO_2 watertrap.
Should hear Technical alarm and see error message.

Press <CO_2/RESP ALARMS Off> button.
Should stop Technical alarm sound, and erase error message, and light
LED in <CO_2/RESP ALARMS OFF> button
If alarm not silenced:
If error message not erased
If LED not lit: Replace Display Board hardware

Press <CO_2/RESP ALARMS OFF> button again.
Should hear Technical alarm sound, see error message, LED unlit in <CO_2/RESP ALARMS Off> button.

Turn system off and back on to clear state.

<BP ALARMS Off> button

3.4 Diagnostic Tests

With no hose connected to BP port, press <BP START/ CANCEL> button.
Place finger over BP port, blocking flow, causing BP to detect overpressure and abort.
Should hear Technical alarm and see error message.
If alarm not heard:
If error message not displayed

Press <BP ALARMS Off> button.
Should stop Technical alarm sound, and erase error message, and light
LED in <BP ALARMS OFF> button
If alarm not silenced:
If error message not erased
If LED not lit: Replace Display Board hardware

Press <BP ALARMS OFF> button again
Should hear Technical alarm sound, see error message, LED unlit in <BP ALARMS Off> button
If alarm not heard:
If error message not displayed
If LED not unlit: Replace Display Board hardware

Turn system off and back on to clear state.

Battery tone
System must have been plugged into AC for at least 2 hours.
Disconnect AC power on running system.
Connect BP hose to simulator.
Press <AUTO> to select 1 minute intervals.
Wait for battery to run down. With fully charged battery, after no less than 50 minutes, should hear single tone, get message that system will shut down in 10 minutes.
If alarm tone not heard:
If message not shown:

Should hear tone again in two minutes, and again two minutes after that.
If alarm tone not heard at two minute intervals:

Five minutes after first message, should start hearing tone every minute, and get message that 5 minutes remain until shutdown.
If alarm tone not heard at one minute intervals:
If message not shown:

3.4 Diagnostic Tests

Ten minutes after first message, should hear technical alarm, see a printout of Trend data if there is any unprinted trend data accumulated, (which there is, we have been running BP measurements) and error message that system shutdown is imminent.

If alarm not heard:
If message not shown:
If Trend not printed:

Plug system back into AC.

BP 1

Connect the BP port to the BP simulator.
Set the simulator for a normal reading (140/80, 100BPM, NSR).
Press <BP START/CANCEL>
System should start pump, display manometer value in SYSTOLIC LED; this value should track and be very close to pressure displayed by manometer in BP simulator (if fitted).
Largest number shown in SYSTOLIC should be very close to the **Initial pressure** setting recorded earlier from Advanced Configuration in step Test Setup 1.
System should step down pressure, showing step values in SYSTOLIC LED, and then display correct SYSTOLIC and DIASTOLIC values.
System may show MAP value depending upon country and Advanced Configuration setting.

If in-process display is wrong calibrate or blank: replace main board
If final Systolic / Diastolic / MAP display is incorrect: Calibrate BP

Press <DATE/TIME><TREND> to get to Advanced Configuration menu
Press <Select> to highlight **Initial pressure**
Press <Set> to change **Initial pressure** to 280 mmHg
Press <Select> to highlight **MAP**
Press <Set> to change **MAP** to **Yes**
Press <TREND> to return to idle screen.

Press <BP START/CANCEL>
System should start pump, display manometer value in SYSTOLIC LED; this value should track and be very close to pressure displayed by manometer in BP simulator (if fitted).

3.4 Diagnostic Tests

Largest number shown in SYSTOLIC should be very close to the **Initial pressure** setting of 280 mmHg.

If pressure shown exceeds 300 mmHg: Replace Main Board hardware

System should step down pressure, showing step values in SYSTOLIC LED, and then display correct SYSTOLIC and DIASTOLIC values.
System should show MAP value. MAP value should match what is shown by simulator.

If in-process display is wrong or blank:

If final Systolic / Diastolic / MAP display is incorrect: Calibrate BP

Set simulator to highest Systolic <=250, lowest Diastolic >= 30, and lowest heart rate >=30
Press <AUTO>
X goes unlit, 1 flashes for 10 seconds
20 seconds after 1 stops flashing, BP measurement starts
BP reading as above.

If BP does not start: Replace Main Board hardware

If BP measurement incorrect: Calibrate BP

No less than 30 seconds after completing the measurement another measurement should start.

If measurement does not start automatically: Replace Main Board hardware

While it is pumping up, press <BP START/CANCEL>.
Measurement stops immediately and pressure is dumped (as seen on manometer on simulator).

If measurement does not stop immediately: Replace Main Board hardware or Display Board hardware (if button is the problem)

If pressure does not drop below 10mmHg immediately: Replace Main Board hardware, BP Valve

Press <AUTO> and X lights up (not flashing)

Disconnect the tubing from the BP port on the Atlas.
Press <BP START/CANCEL> and note the time (to the second)
The BP should abort with an alarm after no longer than one minute?

3.4 Diagnostic Tests

ECG 1

Connect a 5 lead cable set to the simulator and to Atlas.
Configure the simulator for NSR 100BPM and Impedance Respiration,
Plug the cable into Atlas.
Press <DATE/TIME> <TREND>
Get Advanced Configuration menu.
Press <Select> to highlight **ECG lead set**
Press <Set> to:
Set **ECG lead set** to **5 wire**
Set **ECG gain** to **Automatic**
Set **ECG speed** to **25mm/s**
Set **ECG bandwidth** to **Monitor**
Set **Second trace selection** to **ECG**
Press <TREND> to return to idle screen
Should see:

- ECG cascading onto second line
- Scale bar on left of top line
- Heart rate displayed as set on simulator
- Lead Selected = II
- Heart rate tone high pitched
- If ECG waveform not seen
- If ECG waveform not cascading
- In Scale Bar not on top line
- If Heart Rate not displayed (or displayed incorrectly)
- If Lead Selected not shown
- If Heart rate tone not heard
  - Re-install software
  - Replace CPU board
  - Replace Main board

Press <LEAD SELECT> and step through each of the lead settings
Should see:

- Different looking ECG waveforms
- Heart Rate will go to dashes and alarms on some leads

Set lead selected to II
Press <DATE/TIME><TREND>
Get Advanced Configuration menu.
Press <Select> to change **Second trace selection** to **Respiration**
Press <TREND> to return to idle screen
Should see:

- ECG on top line
- Scale bar on left of top line
- Heart rate displayed as set on simulator

3.4 Diagnostic Tests

Lead Selected = II
Pulse tone high pitched
Respiration waveform on second line
Respiration Rate displayed as set on simulator
If ECG waveform not seen
If ECG waveform not cascading
In Scale Bar not on top line
If Heart Rate not displayed (or displayed incorrectly)
If Lead Selected not shown
If Heart rate tone not heard
If Respiration waveform not shown
If Respiration Rate not displayed correctly
Re-install software
Replace CPU board
Replace Main board
Disconnect ECG simulator
Turn system off and back on to clear state.

SpO_2 1

Note: The Nellcor or Nonin should be accurate* to the simulators.

*2% or 3bpm for any in-range settings on the simulators.

Connect SpO_2 cable and cuff and install cuff on simulator (or your finger).
Set simulator to normal readings.
See pleth signals immediately
If Pleth signals not seen within 10 seconds: goto SpO_2 2

See SpO_2 percentage within several seconds
If SpO_2 percentage not seen within 1 minute: goto SpO_2 2

See Pulse display at the same time as SpO_2 percentage
If Pulse display not seen at same time as SpO_2 percentage: goto SpO_2 2

Disconnect SpO_2 cuff from simulator
Technical alarm sounds
See error "SpO_2 cuff not detected"
If alarm not heard: goto Sound 1
If error not seen:

Reconnect SpO_2 cuff to simulator
Technical alarm stops
Error message erased
Unplug SpO_2 cable from Atlas
Technical alarm sounds
See error "SpO_2 cable missing"

3.4 Diagnostic Tests

If alarm not heard: goto Sound 1
If error not seen: Re-install software

Turn system off and back on to clear state.

SpO_2 2

Verify that proper SpO_2 cuff is being used: Nonin or Nellcor
Replace cuff.
Check cable connections between SpO_2 board and Main board
Replace SpO_2 cuff socket
Replace SpO_2 board

CO_2 1

Press <DATE/TIME><TREND>
Get Advanced Configuration menu
Set **Second trace selection** to **CO_2**
Press <TREND> to return to idle screen
Insert watertrap with tubing attached
Should see:
Hear pump motor start
See dashed line waveform on lower trace
See dashes in Respiration Rate
See 0 in mmHg (or % or kPa, as configured)
If pump motor does not start: goto CO_2
If dashed waveform does not start: Perform CO_2 calibration
If Respiration Rate does not display dashes: Per form CO_2 calibration
If CO_2 concentration is not 0: Perform CO_2 calibra tion

Breathe gently and repeatedly over end of tubing
Should see:
See waveform within seconds of breathing
See respiration rate non zero within one minute
See CO_2 concentration non zero within one minute
If waveform does not track breathing: Perform CO_2 calibration
If respiration rate does not show reasonable value: Perform CO_2 calibration
If CO_2 concentration does not show reasonable value: Perform CO2 calibration

If CO_2 calibration did not solve problem, replace CO_2 board
Remove watertrap from Atlas
Turn system off and back on to clear state.

Press <DATE/TIME><TREND>

3.4 Diagnostic Tests

CO_2 2

Get Advanced Configuration menu
Set **Second trace selection** to **CO_2**
Press <TREND> to return to idle screen
Remove and reinsert watertrap in socket. Make sure that it seats fully.
- If pump does not start:
  - Insert finger in socket and attempt to press microswitch
  - If pump does not start:
    - Check connections between CO_2 board and Main board
    - Check connections between CO_2 receiver and CO_2 board
    - Replace CO_2 receiver
    - Replace CO_2 board

TEMP1

Temp display is blank
Connect temp probe
See temp display of ambient temperature
- If display is not close to ambient temperature: Calibrate Temp – if out of spec, replace probe, repeat. If still out of spec, replace main board.

Disconnect temp probe
Temp display becomes dashes
- If temp display does not become dashes: Replace main board

Bad Boot 1

Turn power off and back on and see if anomaly returns
Re-install software
Repeat test
- If problem remains: Replace CPU board

Fan 1

Models 622xx and 623xx:
If fan does not start when power turned on:
- Check Fan to Main board cable
- Replace Fan
- Replace Main board

About Section 4

This section is a guide for disassembly and reassembly of the Atlas Monitor. Always refer to current revision schematics, diagrams and final safety test procedures before attempting to service this device.

Do not attempt to service this instrument unless you have received Service Training from Welch Allyn or an authorized agent, and are equipped with approved processes and test equipment. For more information about this call the Welch Allyn Customer Service phone number listed in Section 1 of this manual.

General:

The outside housing is removed to provide full access to all internal printed circuit boards and other components. Most of these are held in position with the surrounding "E-Pac" foam. E-Pac provides shock absorbtion, ventillation channels, and spaces for the components and boards. Pneumatic tubing and cables must be placed correctly in E-Pac to avoid problems with pinched tubing.

Problems During Service:

A Technical Support phone number is listed in Section 1 of this manual to answer questions you may have during the servicing of the Atlas Monitor.

Printer:

Print-head, printer motor, and printer roller can be replaced as necessary.

Printed Circuit Boards:

There are no component level repairs for the Printed Circuit boards. These are replaced if found to be defective. During the warranty period, boards that are found to be defective should be returned to Welch Allyn.

CRT:

The CRT and CRT Deflection Board are aligned at the factory and as such are replaced as a matched set if one or the other should fail in service.

Abstract of Disassembly and Reassembly:

EXERCISE EXTREME CAUTION WHEN SERVICING THE ATLAS MONITOR! THE CRT ASSEMBLY AND CRT DEFLECTION BOARD OPERATE ON APPROXIMATELY 8,000 VOLTS.

CAUTION

Unplug Monitor from Mains before disassembly! EXERCISE EXTREME CAUTION WHEN SERVICING THE ATLAS MONITOR! THE CRT ASSEMBLY AND CRT DEFLECTION BOARD OPERATE ON APPROXIMATELY 8,000 VOLTS.

ESD: Circuit boards are sensitive to static electricity. Use wrist strap, ESD mats and ESD storage bags.

4.1 MODEL 200 Dissassembly.

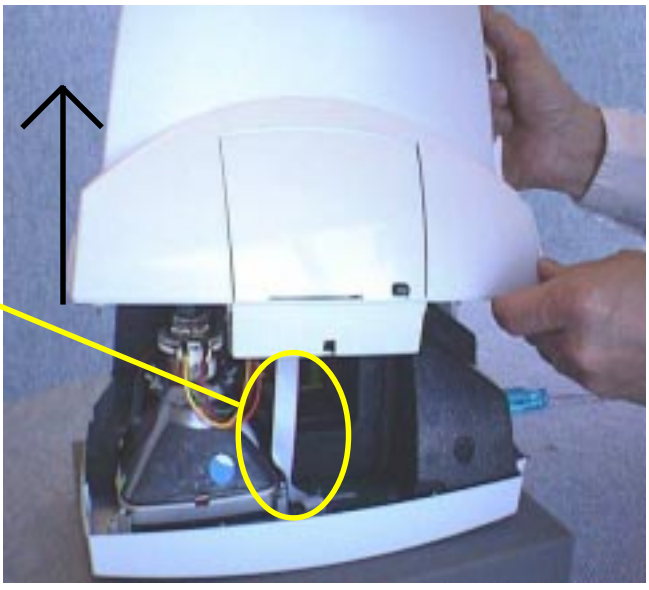
4.1.1 Open the paper door and remove the paper roll. Close paper door.

Place Monitor on a foam pad to protect the front of the unit and the pressure fitting on the front of the unit.

4.1.2 Remove 4 Torx Machine screws with Torx - 10 screw driver.

4.1.3 Open the rear housing and disconnect 2 ground wires from ground lug as well as printer cable..

Caution: Do not pull display cable.

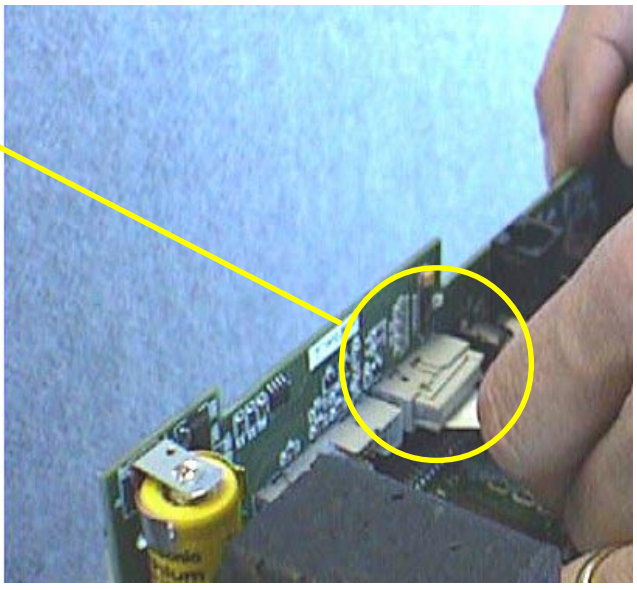


4.1.4 Unplug the printer cable from jack J7 of the Main PCB.

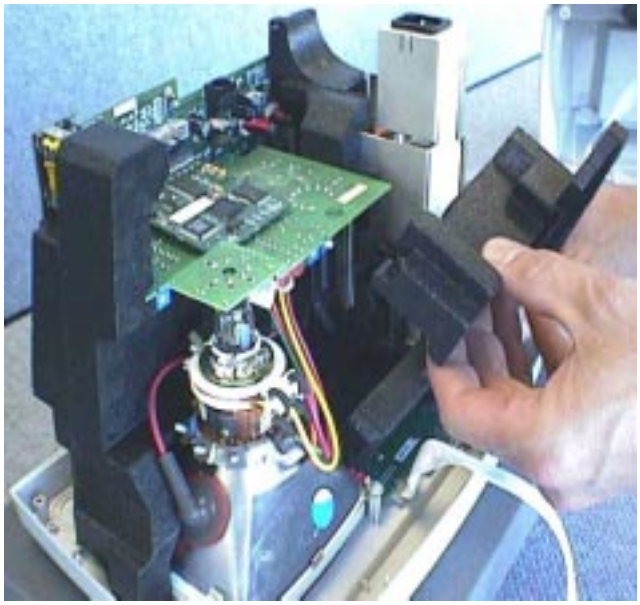
4.1.5 Remove Pump section.

4.1.6 Unplug Display Board Cable from jack J8 of the Main PCB.

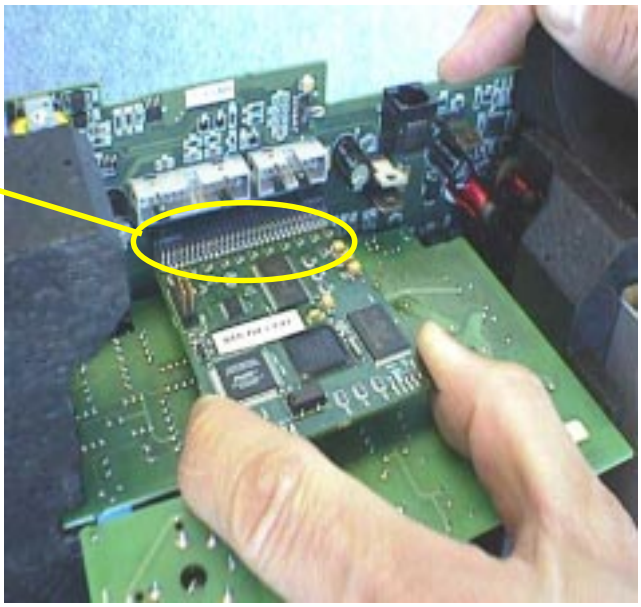
Note: Make sure this end of the cable is installed in J8 during reassembly so that cable folds will be correct.



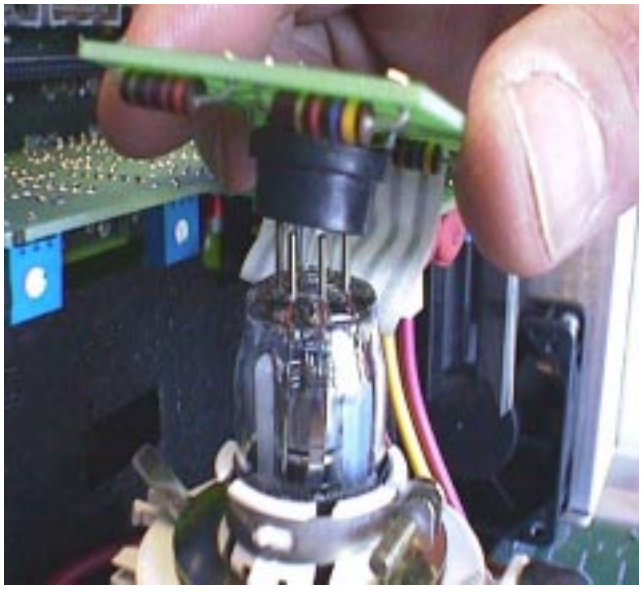
4.1.7 Remove E-Pac from over the CRT.



4.1.8 Unplug CPU/PCB from Main PCB PCA connector J4.



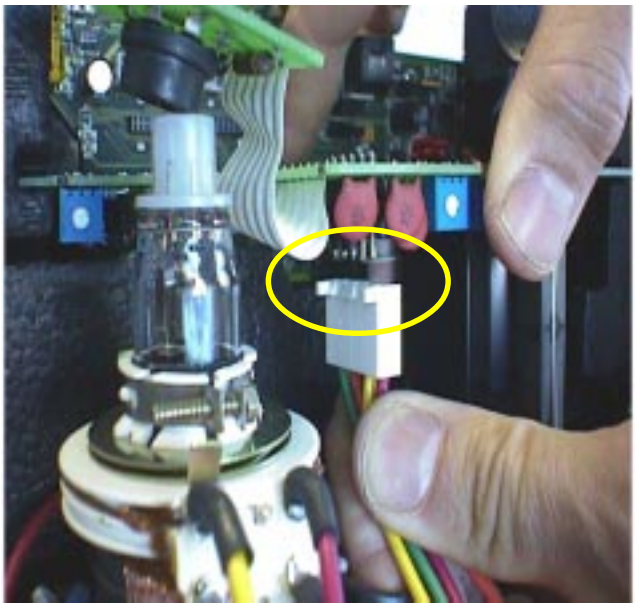
4.1.9 Unplug CRT socket board.



Do not bend pins.

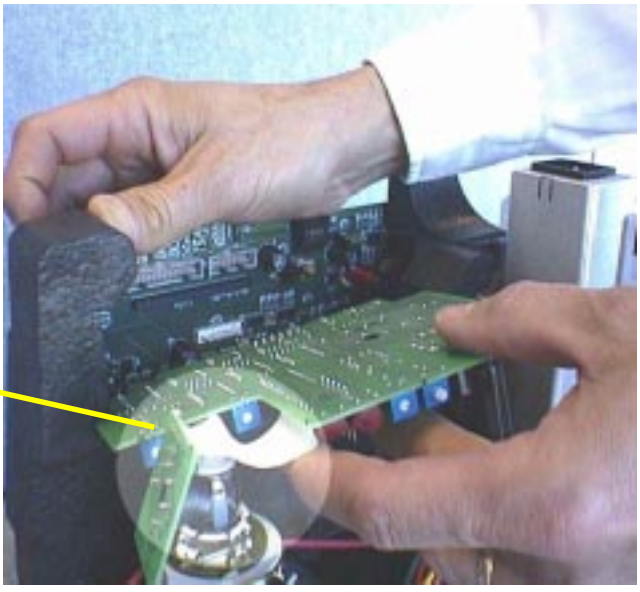
4.1.10 Protect CRT pins with cap T-XXXXX

4.1.11 Unplug Yoke cables from connector J2 of CRT Deflection Board.

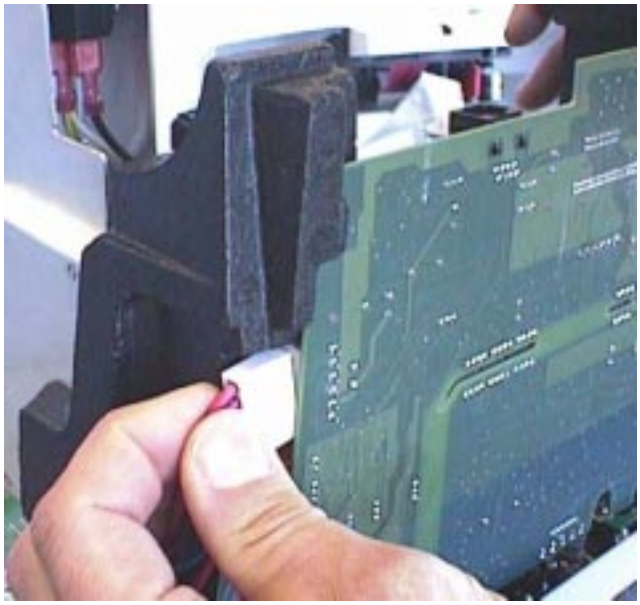


4.1.12 Unplug CRT Deflection Board from Main PCB with connector tool T-16654

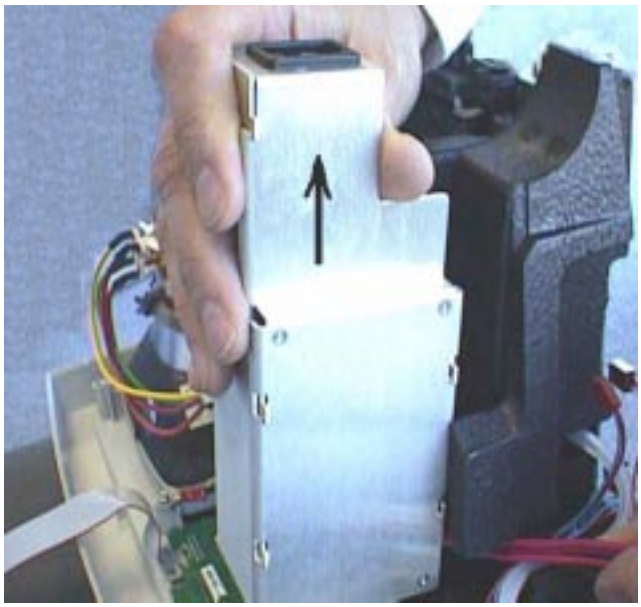
Do not bend pins.



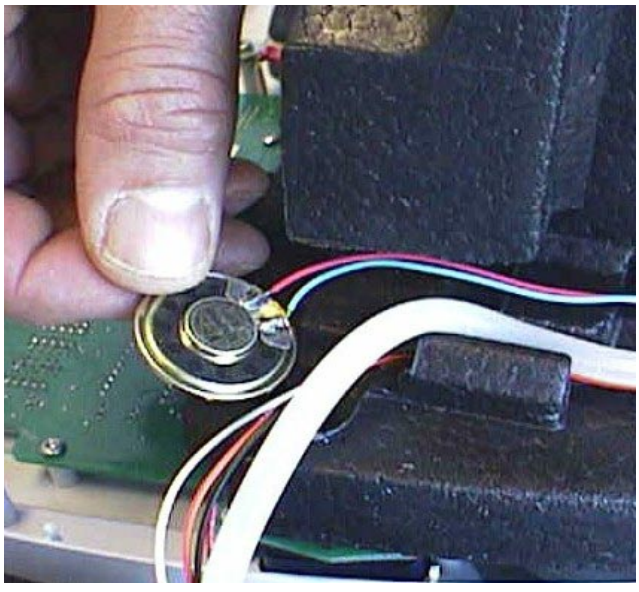
4.1.13 Unplug 4 connectors from side of Main PCB.



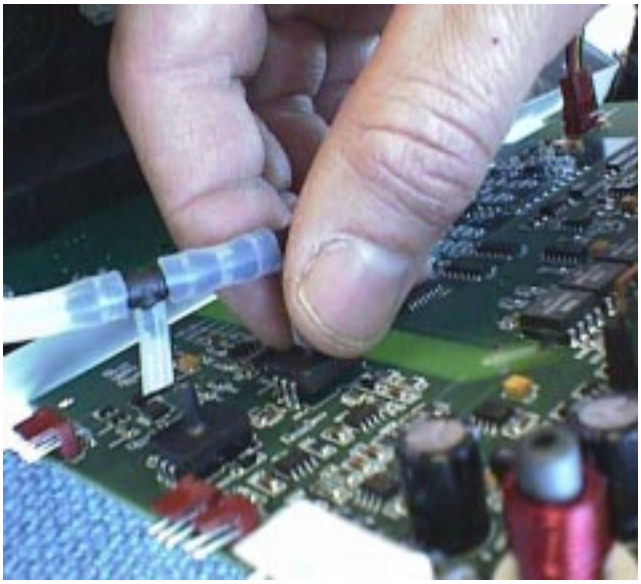
4.1.14 Remove Power Supply assembly.



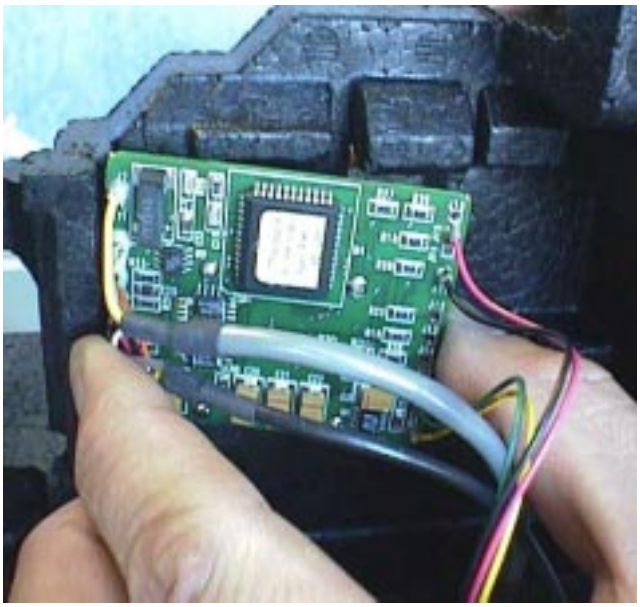
4.1.15 Remove alarm speaker.



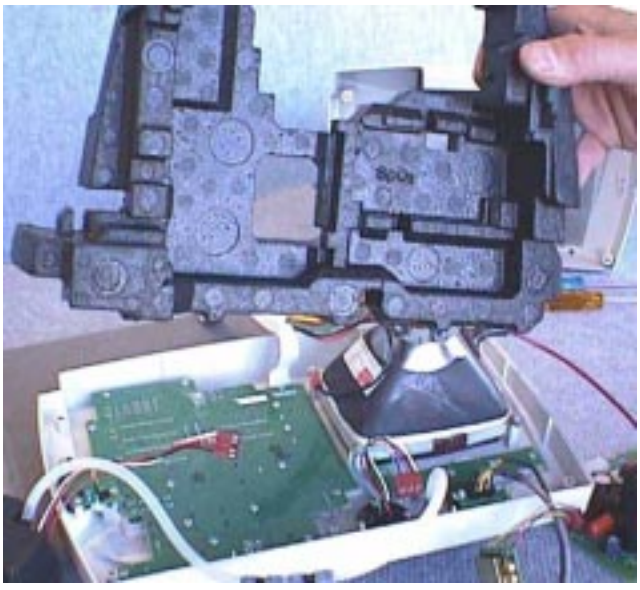
4.1.16 Remove Main PCB from E-Pac and disconnect tubing and connectors.



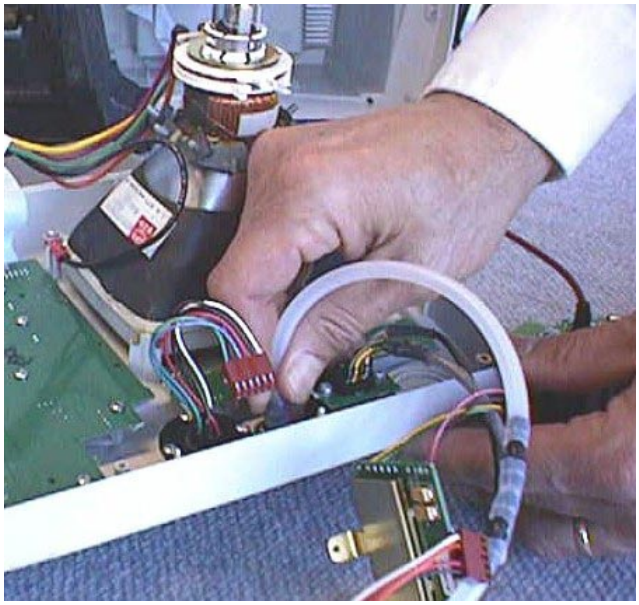
4.1.17 Disconnect SpO_2 board and remove it from E-Pac.



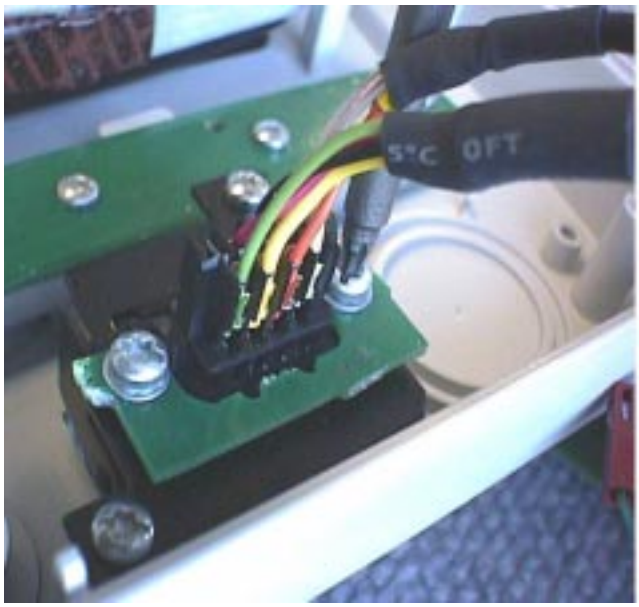
4.1.18 Remove main E-Pac section.



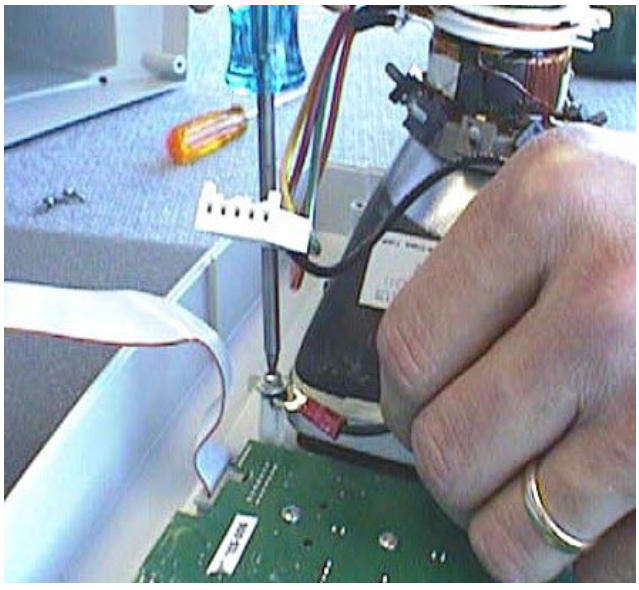
4.1.19 Disconnect tubing from fitting.



4.1.20 Remove SpO_2 connector from front panel.

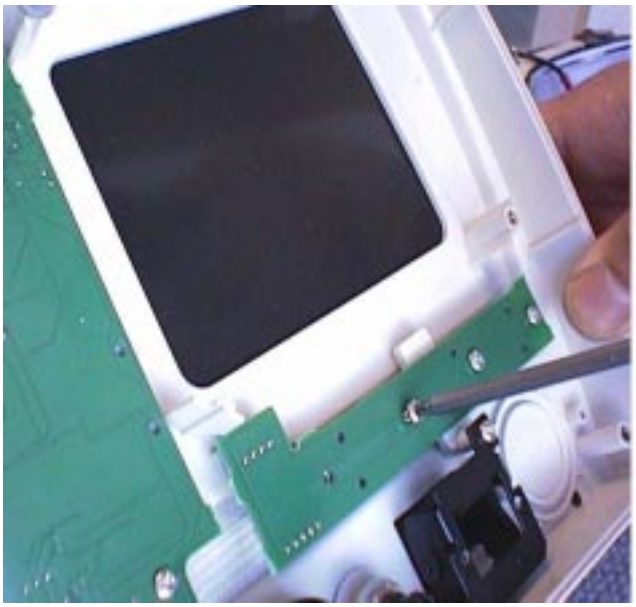


4.1.21 Remove CRT ground wire. Do not remove screw and washer.



4.1.22 Remove opposite CRT
` mounting screw and remove CRT.

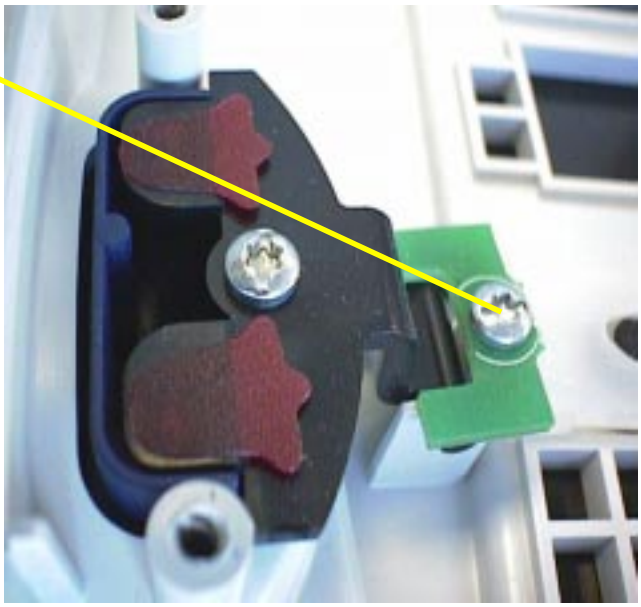
4.1.23 Remove Keypad circuit board.



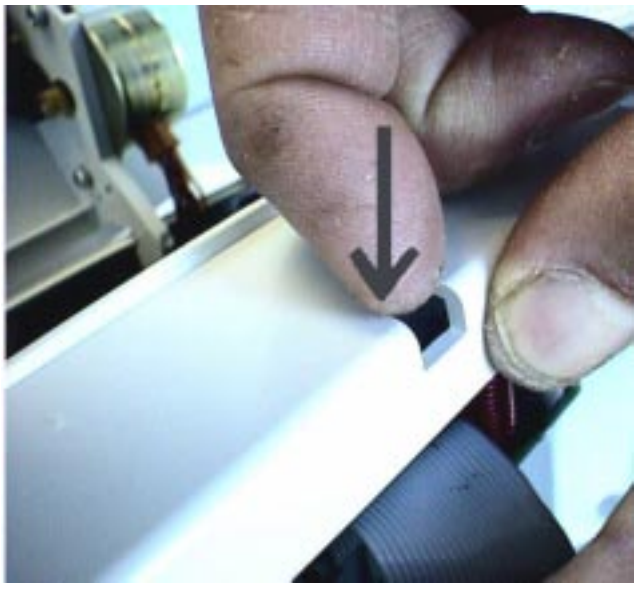
4.1.24 Remove Display PCB.

4.1.25 Remove soft keys from Bezel.

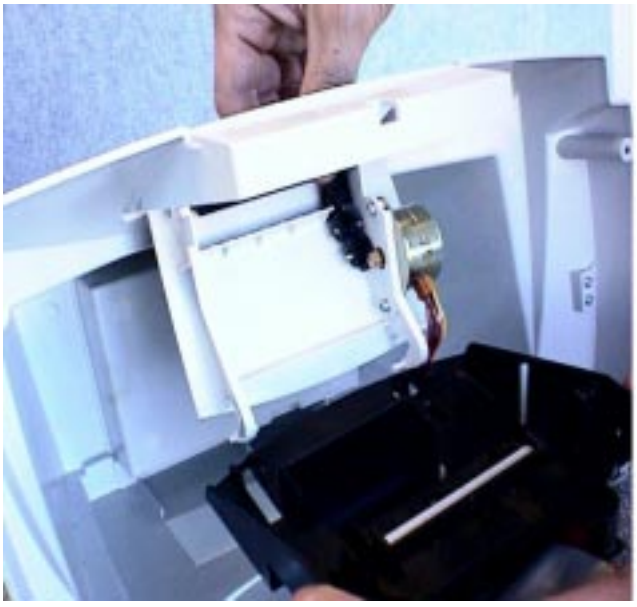
4.1.26 Unscrew Alarm Silence Button holding screw to remove Silence button.



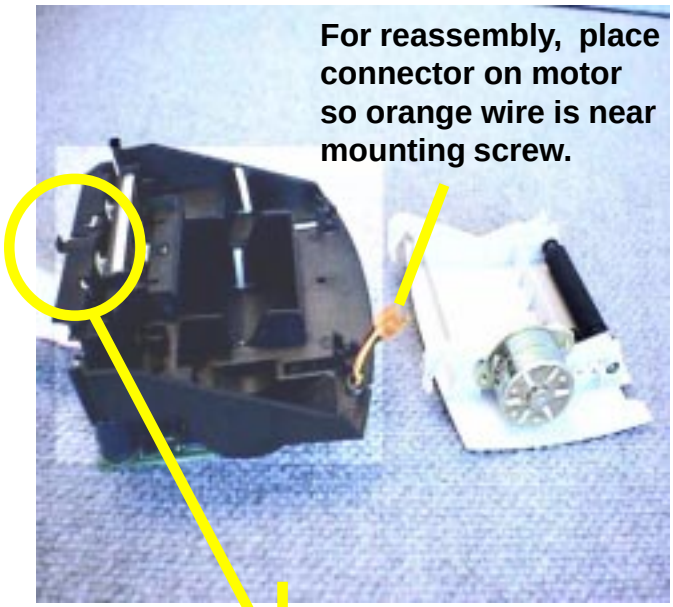
4.1.27 Remove printer by depressing tab.



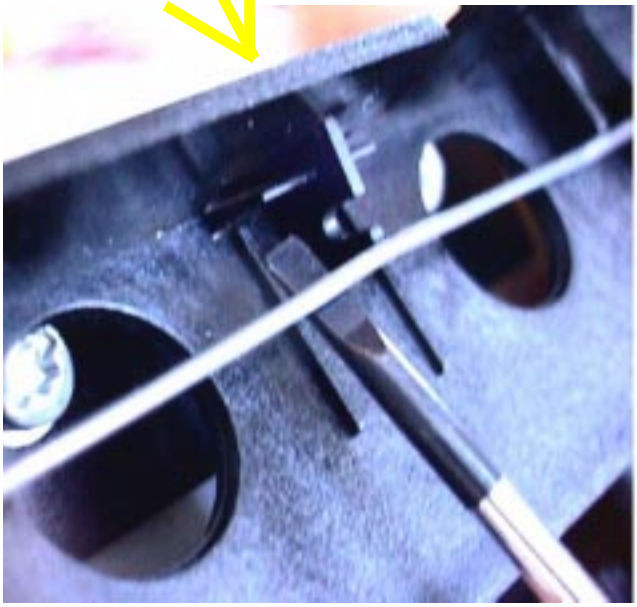
4.1.28 Slide printer out of rear housing.



4.1.29 Unplug motor connector.



4.1.30 To remove printhead, disconnect cable from printer PCB.
Lift spring and remove printhead from printer frame.

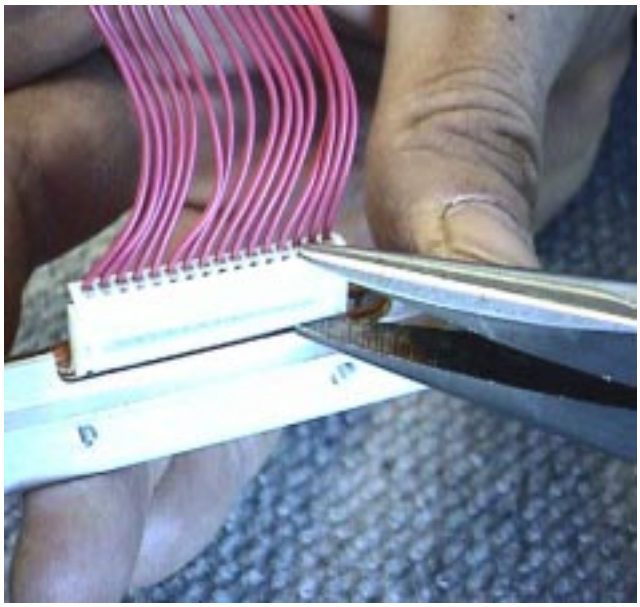


4.1.31 Remove backing plate.

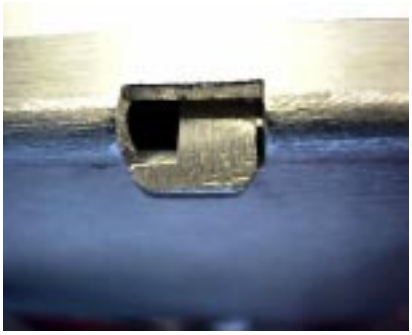
4.1.32 Remove connector.

Flex circuit is delicate. Therefore, do not pull on connector.. Use small screwdriver to pry connector apart.

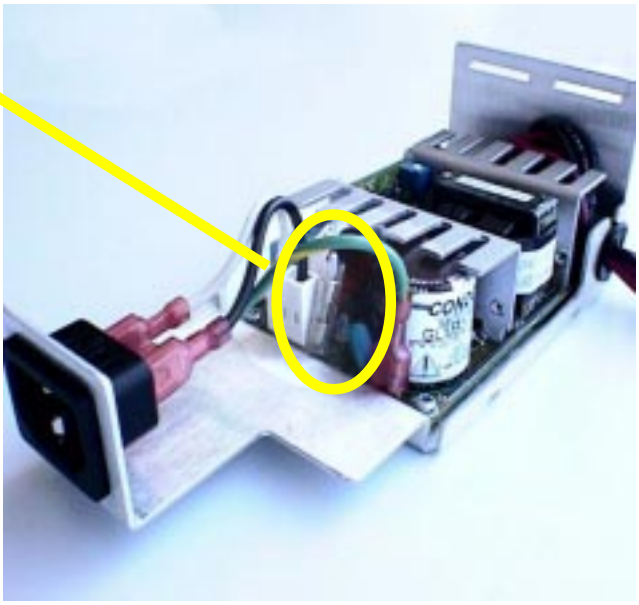
4.1.33 For reassembly of printhead, use long nose pliers to attach cable to eliminate stress on flex circuit of printhead.



4.1.34 Slide Power Supply cases apart.



4.1.35 Location of Power Supply fuse.



4.2 MODEL 200 Re-assembly.

4.2.1 Reassemble in reverse order of disassembly with special attention to paths for cables and tubing.

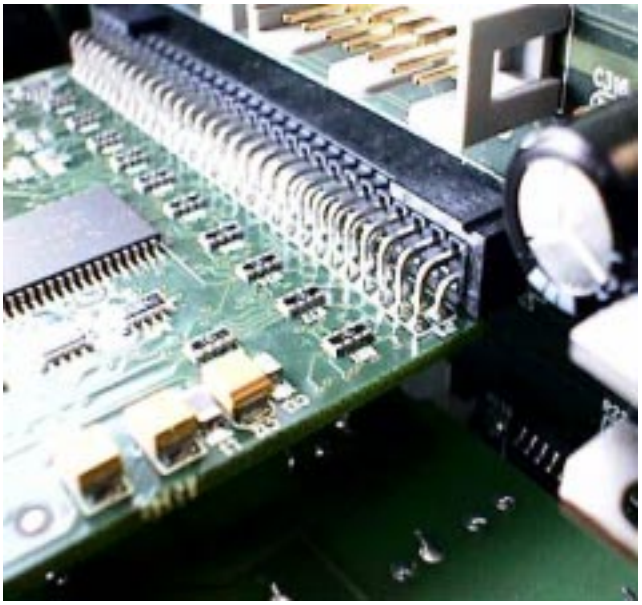
Two types of screws are used. Display PCB is fastened with self tap.

4.2.2 Detail of Pump/Valve/CheckValve subassembly for reassembly.

4.2.3 Printer chassis rests on lip at back of case.

4.2.4 The IEC connector must be centered in the hole before 4 screws can be installed.

4.2.5 Plug MCU/PCB in like this.



4.3 Other models dissassembly/ reassembly.

Due to the similarities between the ATLAS models, only key points are shown. Refer to the latest revision interconnect drawing, schematics, and layouts when servicing this product.

Theory of Operation – Model 622/623

6 Recorder Electronics

6.1 Overview:

6.2 Power Supply – 24 Switcher

6.3 Motor Driver:

6.4 Temperature Amplifier:

1 DC/DC Power Supply

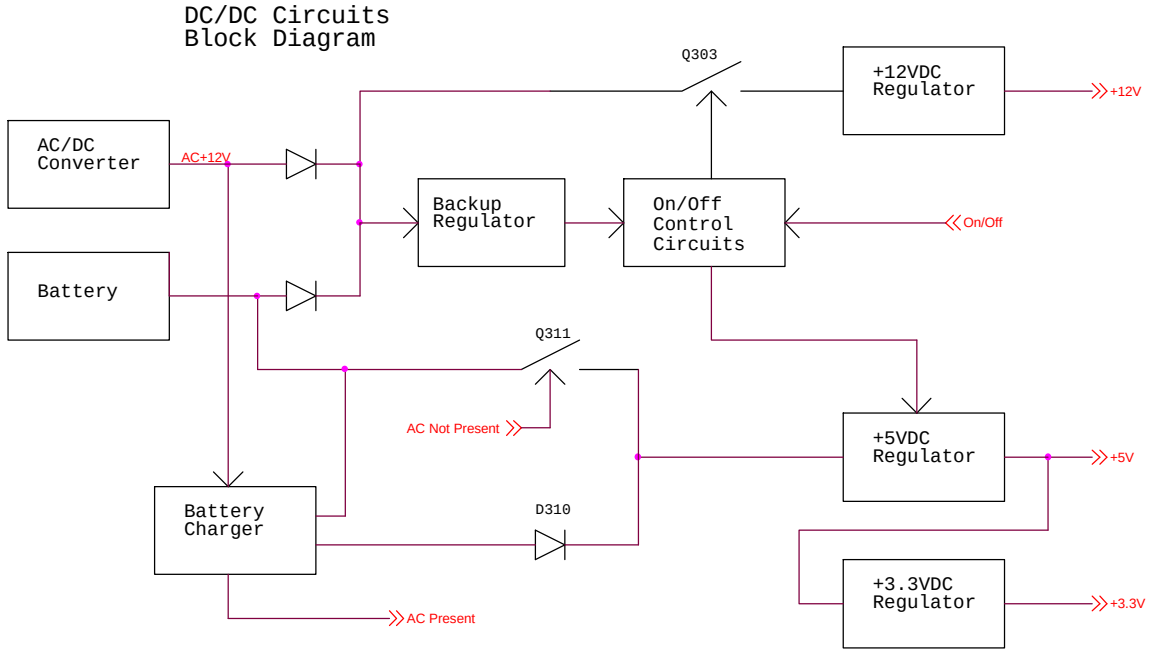
1.1 *Overview:*

Atlas Model 622 and 623 can be powered either from AC or battery. A 50W, medical grade, offline switcher provides 12VDC from a universal AC input (85VAC to 264VAC – 50/60Hz). The battery is a rechargeable 6-Volt, 6.5 Amp-Hour, Sealed Lead Acid Battery, and will provide about 1.5 hours on a fully charged battery (Battery Life depends on usage, especially printer usage, NIBP cycles, and CO2 operation).

The unit will operate from AC when the unit is plugged in, and switches to battery operation when AC is removed. The battery is automatically charged whenever AC is connected.

The following supplies are generated on the Atlas Main Board:

+12V DC	Input: Output of AC/DC supply or Battery. Supply for CRT and miscellaneous analog circuits.
+5V DC	Input: Output of Battery Charger or Battery. Supply for front panel LED's.
+3.3V DC	Input: +5V DC Supply for CPU board.
Backup Regulator:	Input Output of AC/DC supply or Battery. 3.3V supply, for real time clock and On/Off circuits.
Battery Charger:	Input: Output of AC/DC supply Charge SLA battery.



1.2 *On/Off Circuits*

1.2.1 Backup Regulator and Micro-Controller

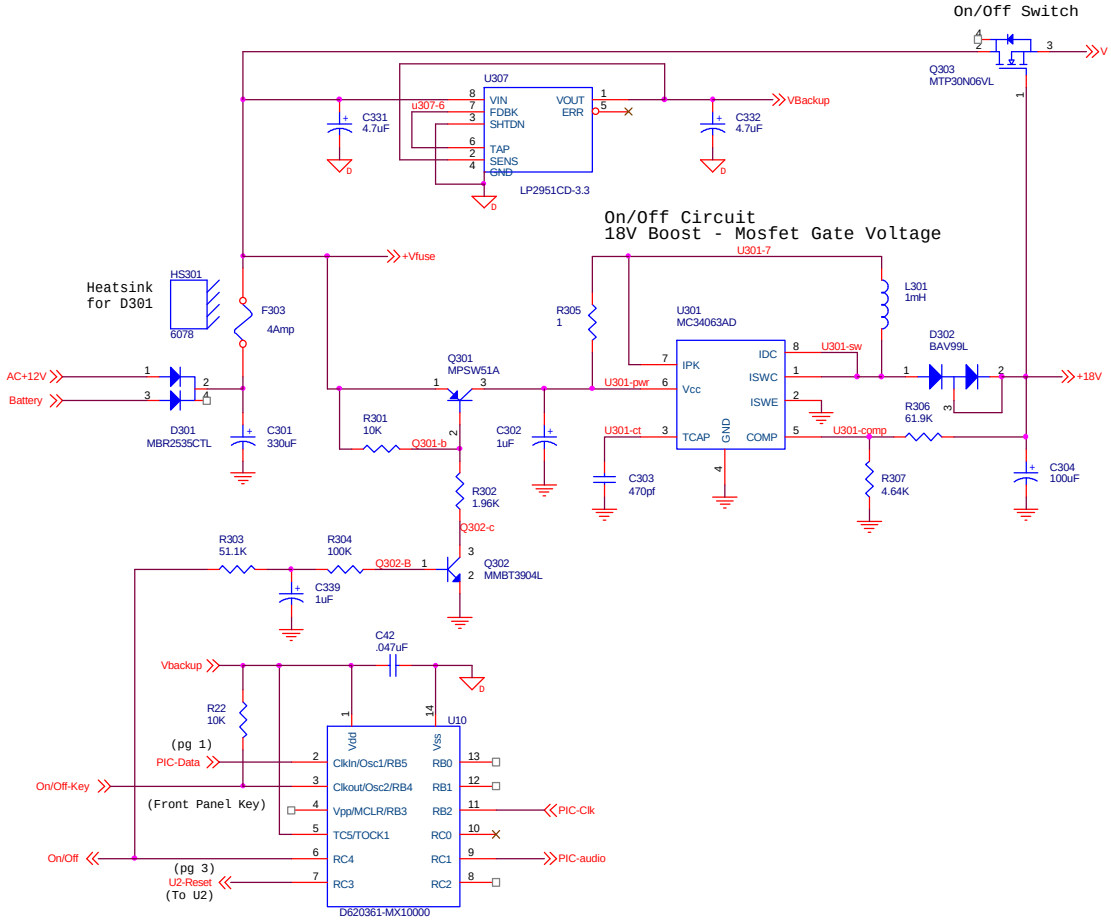
A 3.3V low backup regulator, U307, provides power to the On/Off circuits and provides power to the real time clock on the CPU board. The On/Off circuitry is controlled by the mirocontroller U10. This

controller performs the following functions:

1. Monitors the status of the front panel ON-OFF key. If the unit is off and the ON-OFF key is pressed, the controller will drive U10-6 high, which will enable power to the remainder of the instrument.
2. At power up, the microcontroller will drive the beeper for about 1 second.
3. At power up, the microcontroller will reset Shift Register U2. This will cause the following:
   The front panel LED's are blanked.
   The NIBP pump drive is placed in the off state.
4. When the unit is powered on the microcontroller will communicate with the system CPU. When the front panel ON-OFF key is pressed, the CPU will store away present operating conditions, then issues a command to the microcontroller to shut instrument power off. U10-6 is driven low which will remove power from the remainder of the instrument.

1.2.2 18V boost converter and FET ON/OFF switch

The PWM controller, U301, is configured as an 18V boost-converter. An N-Channel MOSFET transistor, Q303, is used to switch power to the 12V regulator. As Q303 is configured as a high side switch, it is necessary to develop a gate voltage of proper magnitude to turn Q303 on. Then, to enable power to the 12V regulator, the following takes place:
1. The microcontroller drives U10-6 high, turning transistor Q302 on.
2. Transistor Q301 is switched on, supplying power to the PWM controller, U301.
3. The boost regulator develops 18VDC, which will switch transistor Q303 On.



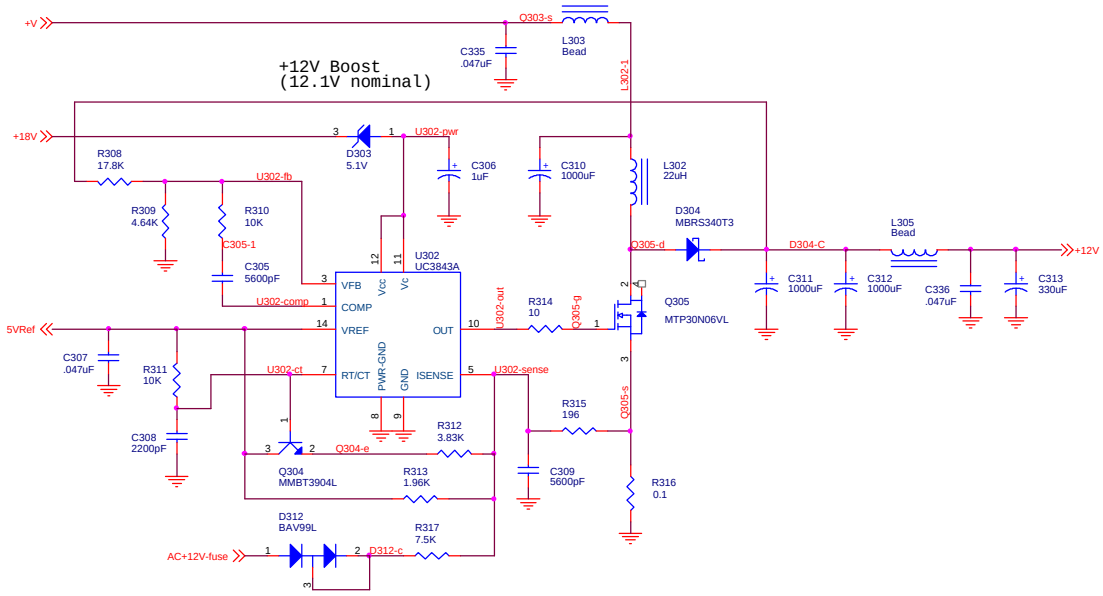
1.3 *+12V Boost Converter*

The +12V boost circuit provides regulated 12VDC. The input to the 12V converter is either battery or 12V from the AC/DC converter. The circuit is configured as a boost PWM using current mode feedback. The PWM controller is a UC3843A. The controller includes an internal 2.5V, 2% reference, and an external 5V, 2% reference. Nominal output voltage for the boost converter is Vout = [2.5V*(1 + 173.8K/4.64K)] = 12.1V.

The UC3843A requires 8.5V minimum to power on. The maximum voltage allowed on the switching transistor, Q305, is 15V. To meet both these requirements, the UC3843A is powered from 12.9V (+18V – 5.1V zener diode D303)

When operating from battery, the converter will run at duty cycles over 50%, which requires slope compensation for a current mode controller. Slope compensation is achieved by summing in part of the oscillator signal (pin 4) with the current sense line.

The PWM controller is current limited on a cycle to cycle basis by monitoring the voltage on the Isense line, U302-5. Current limit is activated when the voltage at the sense line reaches 1V. The nominal DC voltage at Isense is about 0.5V when operating from battery only, and 0.7V when operating from AC. Then, current limit is set to 5Amps when Atlas in operating on battery and 3Amps when operating on AC.



1.4 *Battery Charger:*

The battery charger is a PWM buck converter. The input to the battery charger is 12VDC from the offline switcher. The UC3843A, normally a current mode controller, is configured for voltage feedback mode. The UC3843A has an under-voltage lockout for Vcc<8.5V. The controller operates such that with Vcc less than 8.5V, the reference out is 0V, and will be at 5V with Vcc>8.5V. Then, the reference out (pin 14) can be used as an AC-ON detect signal.

The switching transistor for the buck converter is a P-Channel MOSFET (Q308). The output drive of the controller is the wrong polarity for driving a P-Channel MOSFET in a step down mode. Therefor, transistor Q306 is added to invert the PWM out signal. Fast turn-on of Q308 is provided when Q306 is low, fast turn-off is though Q307 (configured as an emitter follower).

The battery charger is a current limited - temperature compensated charger. Current limit is set to 1.5Amps. Current through the 0.1Ohm sense resistor R327 is measured with Diff-Amp U305B. When the charger current is at 1.5Amps, feedback is controlled by Op-Amp U304A. When the current drops below 1.5Amps, the output of U304A goes low, reverse biasing Diode D308, and feedback will be controlled by Op-amp U304B.

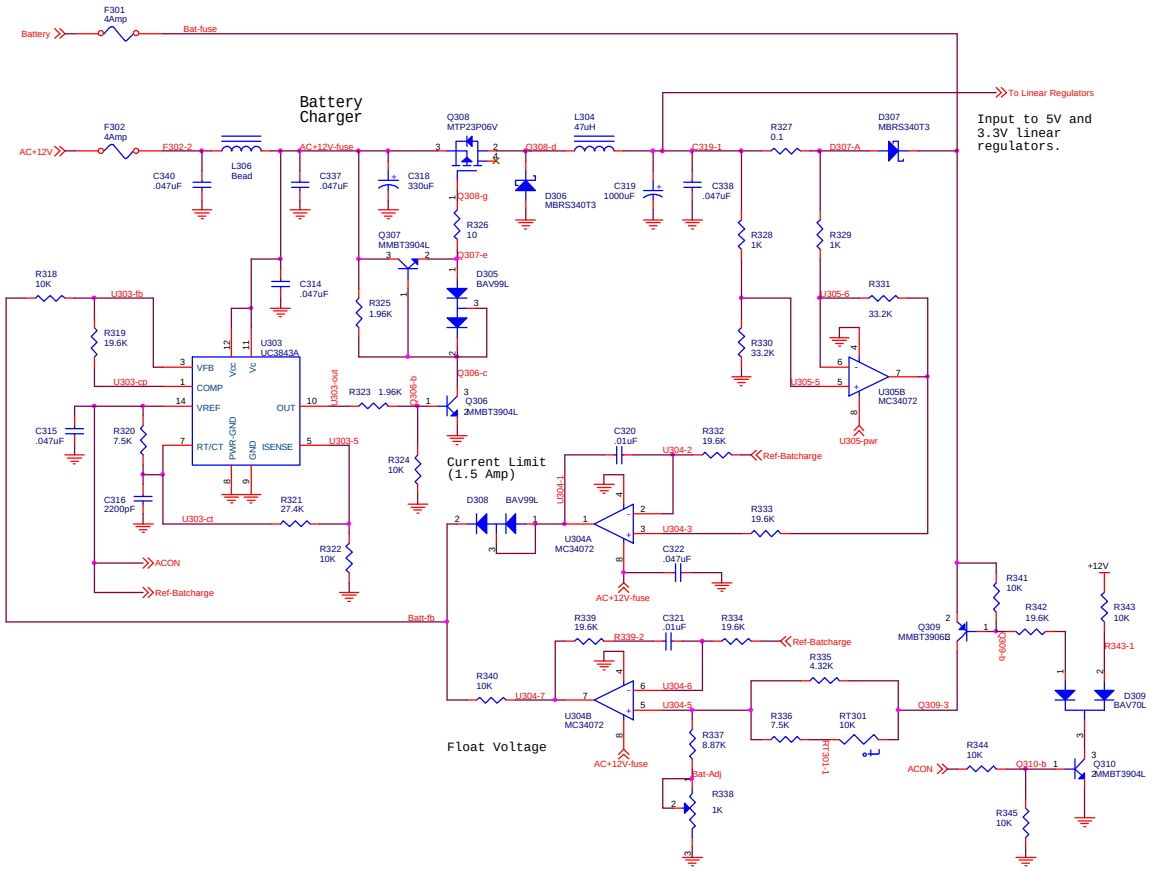
Battery charge voltage is temperature compensated using Thermistor RT301, a 10K negative temperature coefficient resistor. Voltage over temperature follows the following charge profile:

Temperature	Voltage	Thermistor
0C	7.05V	26.9K
10C	7.0V	20.7K
25C	6.85V	10K
40C	6.7V	5.17K
50C	6.65V	3.45K

For optimum battery life, the float voltage (25C, full charge) should be set to 6.85V +/- 50mV (6.85V +/- 0.7%). To accomplish this tight tolerance, charge voltage at room temperature will be adjusted with potentiometer R328. Nominal charge voltage at room temperature is:
Vcharge = 5V * (1 + RA/RB) where,

5V is the reference in U303.
RA is the series/parallel combination of R335, R336, and RT301 (nominal 3.465K @ 25C).
RB is the series combination of R337and R338 (nominal 936 Ohms)

It is necessary to minimize current out of the battery when the unit is off. To reduce off current, transistor Q309 disconnects the battery from the battery sense resistors when AC in off. In addition, diode D307 is added to prevent current from flowing from the battery into the battery current sense circuit, and to the output of the AC/DC converter.



1.5 *Linear Regulators – 5VDC and 3.3VDC*

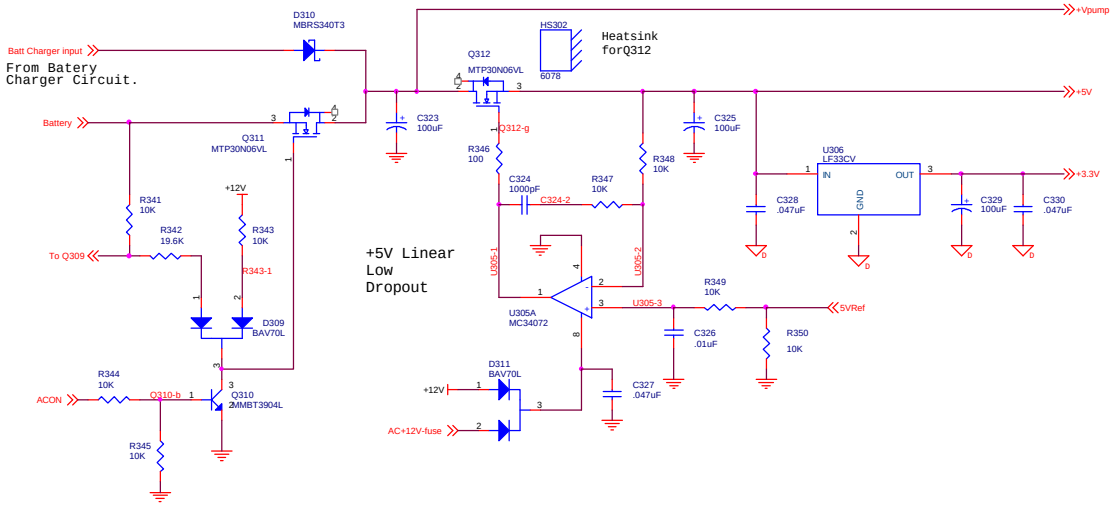
1.5.1 5V regulator

A series pass 5V regulator is built using transistor Q312 and op amp U305A. The reference for the regulator is the 5V reference from the PWM control IC U302. The output of the 5V regulator is turned off when the unit is turned off. When the 18V-boost circuit is shut down, power is removed to U302, and then the U302 reference is driven to 0V. Setting the reference to 0V will cause op amp U305 to turn the series pass transistor Q312 off.

When operating from AC, transistor Q310 is turned on, which will turn transistor Q311 off. Power to the 5V regulator is then provided through Diode D310 from the output of the battery charger circuit. Note that this voltage tap is before the current sense resistor, then load current on +5V does not affect the battery charger current limit circuit. When AC is removed, the AC-On signal goes low, and Q310 turns off. The gate of Q311 is then pulled up to 11.4V (12V – Vdiode). Transistor Q311 then turns on, and the 5V regulator is powered from the battery.

1.5.2 3.3V Regulator

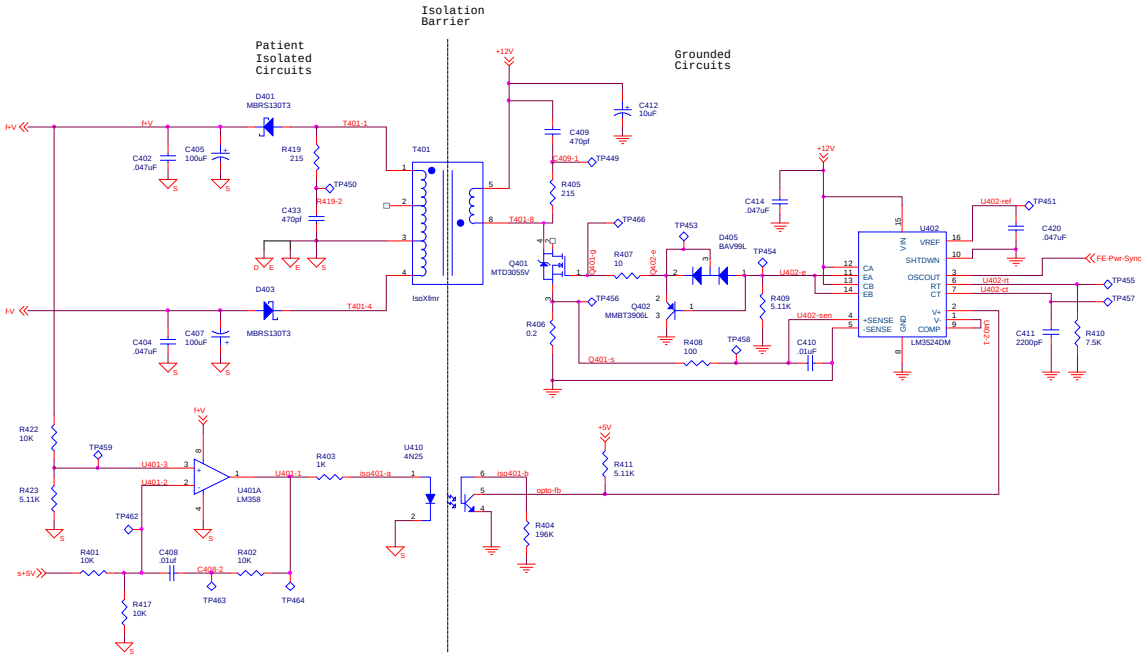
3.3VDC is derived using a three terminal regulator. The output of the 5V regulator is used to power the 3.3V regulator. The 3.3V regulator does not have an independent shutdown, but powers down as the 5V regulator shuts down.



2 Patient Isolated Circuits

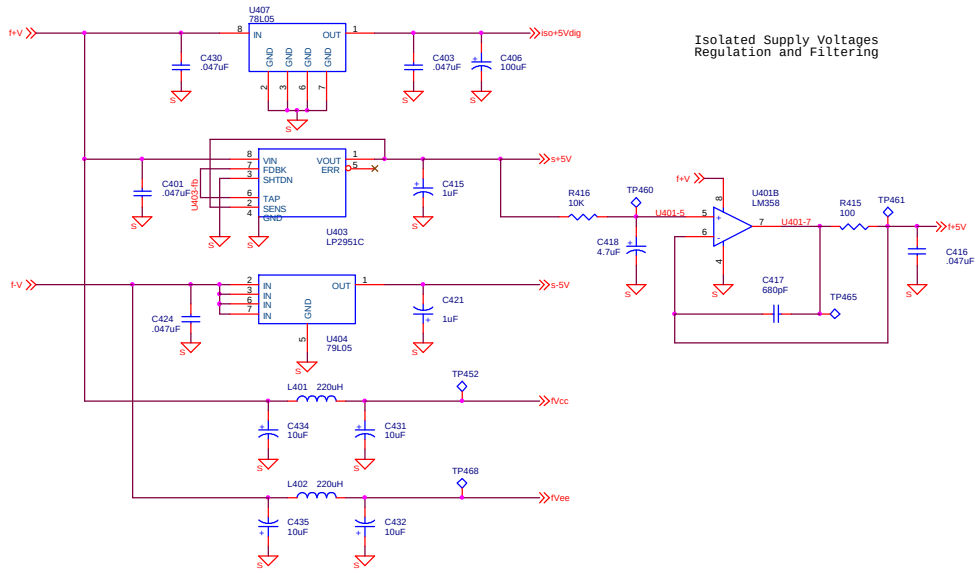
2.1 *Isolated Power*

Isolated power is provided to the ECG, Temperature, Respiration and SpO2 circuits using an Isolation Transformer, T401. The power supply is a PWM controlled flyback converter. The PWM controller is an LM3524. Output voltage f+V is sampled and compared with the reference voltage s+5V. An error voltage is generated, and this voltage returned via opto U410. Voltage f+V is regulated to 7.4V. Additional taps on transformer T401 provide f-V (-7.4V). The switcher operates at 76.8KHz, controlled by a sync signal from the CPU board. The power supply is synchronized with the A/D converter used to digitize ECG, Temperature and Respiration signals.



From the raw f+V and f-V voltages, the following supplies are generated for the various patient isolated circuits:

1. iso+5dig: Regulated 5V supply. This voltage is used to power the opto-isolators, digital control logic, and 5V digital supply for the Nellcor SpO2 board.
2. s+5V: Regulated +5V supply: Analog 5V supply for the Nellcor SpO2 board. This is also the reference voltage used in the regulation of f+V.
3. f+5V: Regulated +5V supply: Filtered and buffered from s+5V, this voltage is used for the A/D reference.
4. s-5V: Regulated –5V supply: Analog –5V supply used for the Nellcor SpO2 board.
5. fVcc: LC Filtered voltage, derived from f+V. This voltage is used to power the Op-Amps used in the ECG, Respiration, Temperature, and A/D circuits.
6. fVee: LC Filtered voltage, derived from f-V. This voltage is used to power the Op-Amps used in the ECG, Respiration, Temperature, and A/D circuits.

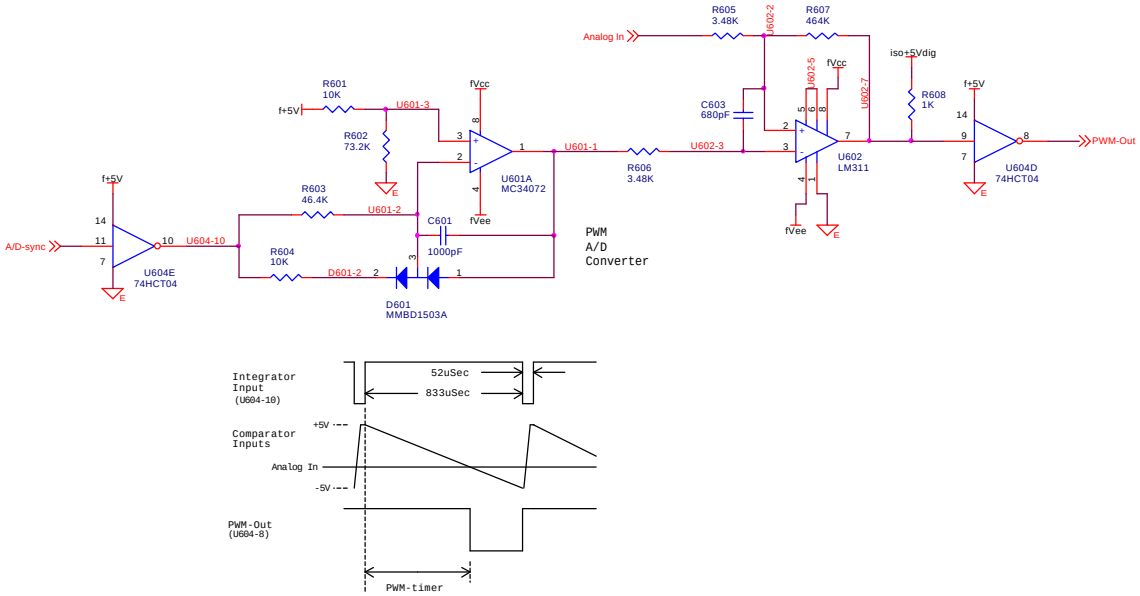


2.2 *A/D Circuits*

2.2.1 PWM A/D

A pulse width modulator is used as an A/D converter. The PWM runs at a 1.2KHz rate, synchronized by the A/D sync signal. A/D sync is low for 52.1uSec, high for 781.25uSec. Using the values shown, the integrator will ramp down 10.01V, and ramp up 25V. The voltage at the integrator output (U601-1) is limited to about 5V [5V*(73.2/83.2) + Vdiode)]. Then, the integrator starts at 5V and ramps linearly down to –5V.

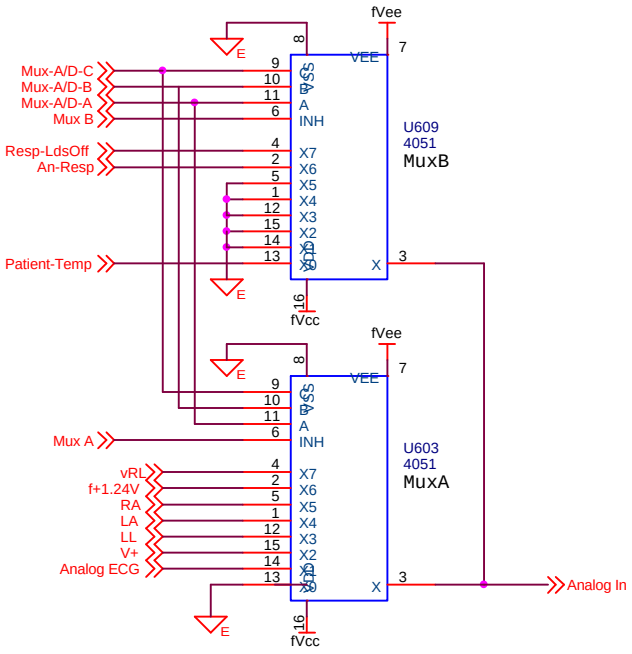
The analog input voltage to be digitized and the integrator output are the inputs to a comparator. The output of the comparator is low at the start of an A/D cycle, and switches high as the integrator ramp drops below the input voltage being digitized (see the timing diagram below). A/D conversion is accomplished by measuring the width of the PWM output signal. The A/D timer runs at 25.175MHz, then the A/D resolution is about 21000 counts (over 14 bits). Hysteresis is added to the comparator to avoid oscillations during switching. Note that since the output of the comparator is low at the start of the A/D cycle, a resistor divider is formed at the comparator input. This divider reduces the Analog-In signal by 0.75% [464K/(464K+3.48K)].



2.2.2 A/D Multiplexer

A 16-channel multiplexer (formed by two 8-channel multiplexers) is used to select the analog signal to be digitized. Control of the multiplexer is through a serial communication channel from the main CPU. The following signals are digitized:

1.	Ground	Ground Reference for digitized signals, used in calibrating the A/D converter
2.	f1.24V	Reference Voltage, used in calibrating the A/D converter
3.	ECG	Amplified ECG signal
4.	V Buffer	Output of the V-lead buffer, used to determine leads off
5.	LL Buffer	Output of the LL-lead buffer, used to determine leads off
6.	LA Buffer	Output of the LA-lead buffer, used to determine leads off
7.	RA Buffer	Output of the RA-lead buffer, used to determine leads off
8.	RL Output	Output of the RL amplifier
9.	Patient Temp	Analog voltage representing patient Temperature
10.	Respiration	Amplified Respiration signal
11.	Resp Leads Off	DC impedance for respiration, used to determine respiration Leads off.



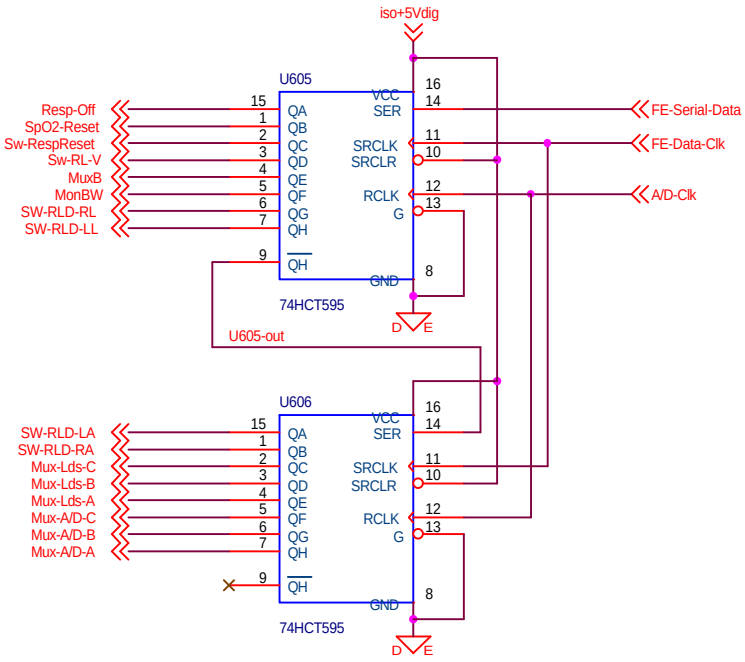
2.3 *Serial Communication*

Serial data is transmitted to the isolated circuits through Optical Isolators. The following signals are transmitted from the CPU board to the isolated circuits:

1. FE-Serial-Data:	Serial Data transmitted from the CPU board to the Isolated circuits.
2. FE-Data-Clk:	Serial Data Clock.
3. A/D Clk:	Serial Data latch. Also used as clock for PMW A/D converter.

Serial Data is converted to a parallel format using Shift Register U605 and U606. The following Data is transmitted from the CPU board to the isolated circuits:

1. Mux-A/D-A	Control bit A for A/D Mux
2. Mux-A/D-B	Control bit B for A/D Mux
3. Mux-A/D-C	Control bit C for A/D Mux
4. Mux-Lds-A	Control bit A for ECG Lead Select Mux
5. Mux-Lds-B	Control bit B for ECG Lead Select Mux
6. Mux-Lds-C	Control bit C for ECG Lead Select Mux
7. Sw-RLD-RA	Switch Reference Electrode to RA
8. Sw-RLD-LA	Switch Reference Electrode to LA
9. Sw-RLD-LL	Switch Reference Electrode to LL
10. Sw-RLD-RL	Switch Reference Electrode to RL
11. MonBW	Select 0.5Hz ECG high pass pole (used to restore ECG baseline).
12. MuxB	0 – Select A/D Mux B; 1 - Select A/D Mux A
13. Sw-RLD-V	Switch Reference Electrode to V
14. Sw-RespReset	Switch Respiration High Pass Pole, used to restore baseline
15. SpO2Reset	Reset Nellcor SpO2 board
16. Resp-Off	Turn respiration off when respiration not used (shuts down drive signal).



2.4 *Signal Isolation*

Optocouplers are used to electrically isolate signals. The following signals are transmitted across the isolation barrier through the optocouplers:

1. SpO2 out:	SpO2 serial data, waveform and status information.
Opto U411	Data from the SpO2 board to the CPU board.
2. Serial Data:	Serial Control data for isolated circuits.
Opto U613	Data from the CPU board to isolated circuits.
3. Serial Data Clock:	Data clock for serial control data.
Opto U612	Clock from the CPU board to isolated circuits.
4. ADC Clock	Clock for PWM A/D converter, also used to latch control shift registers.
Opto U611	Clock from the CPU board to isolated circuits.
5. PWM A/D data	A/D Pulse width data.
Opto U610	Pulse width data from isolated circuits to CPU board.
6. Respiration Clock	Clock for Respiration drive circuit (same signal as power supply sync)
U710	Clock from the CPU board to isolated circuits.

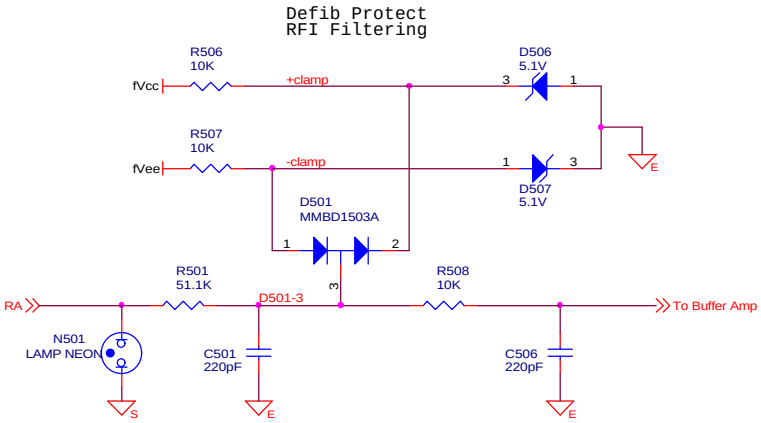
2.5 *ECG Circuits*

2.5.1 Overview

The front end will meet all applicable AAMI standards. Atlas provides a 5-wire front end, and will be compatible with both a 3-wire and 5-wire cable. Monitor (0.5Hz to 40Hz) Extended (0.05Hz to 100Hz) bandwidth will be provided. The ECG amplifier always transmits 0.05Hz to 100Hz data to the CPU board (unless in baseline restore mode), additional filtering for Monitor Bandwidth is implemented in software

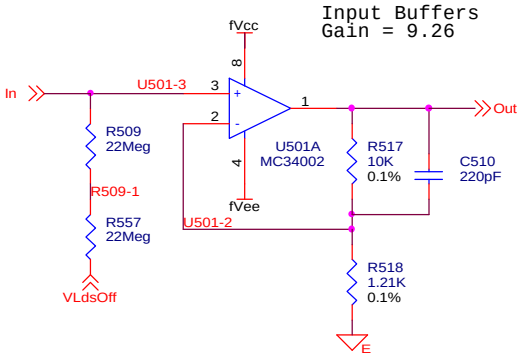
2.5.2 Defib Protect, RFI Filtering

The ECG lead set includes a 1K resistor for current limiting. The neon bulbs act as a voltage clamp, limiting voltage to about 100V. Neons are chosen for their low capacitance and high DC isolation. Series resistors and diode clamps are used as a second set of protection for the front-end amplifiers. Resistors R506, R507 and Diodes D506, D507, are used to reverse bias the lead clamp diodes (D501 to D505). Two passive RC filters are used to reduce susceptibility to RFI and ESU.



2.5.3 Front End Buffer - 1st Gain Stage

Gain of the first stage is 9.26 (1+10K/1.21K). Bias current for each input buffer is set to 1.25V/44Meg = 28nA (VldsOff = 1.25V). On a leads-off condition, the two 22Meg resistor drives the input of the buffer to 1.25V (VldsOff), and the amplifier output saturates high (at about 5.5V). The voltage out of each buffer is monitored to detect a leads-off condition.

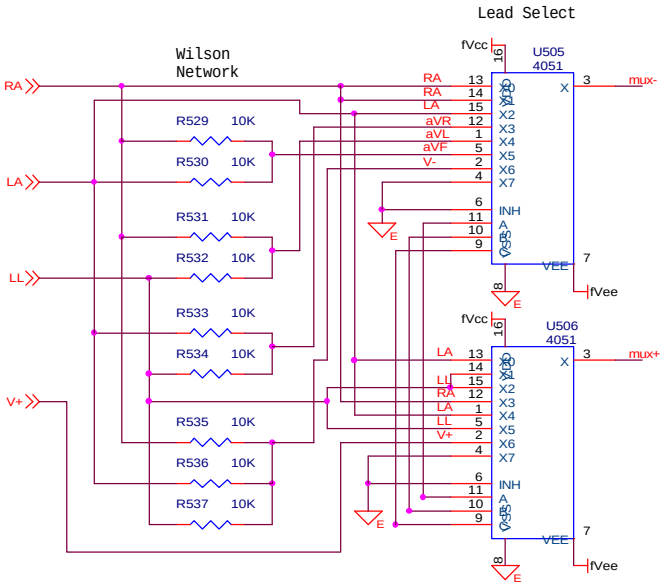


2.5.4 Wilson Network - Lead Select Mux

A 5 wire front end must be able to render the following vectors:

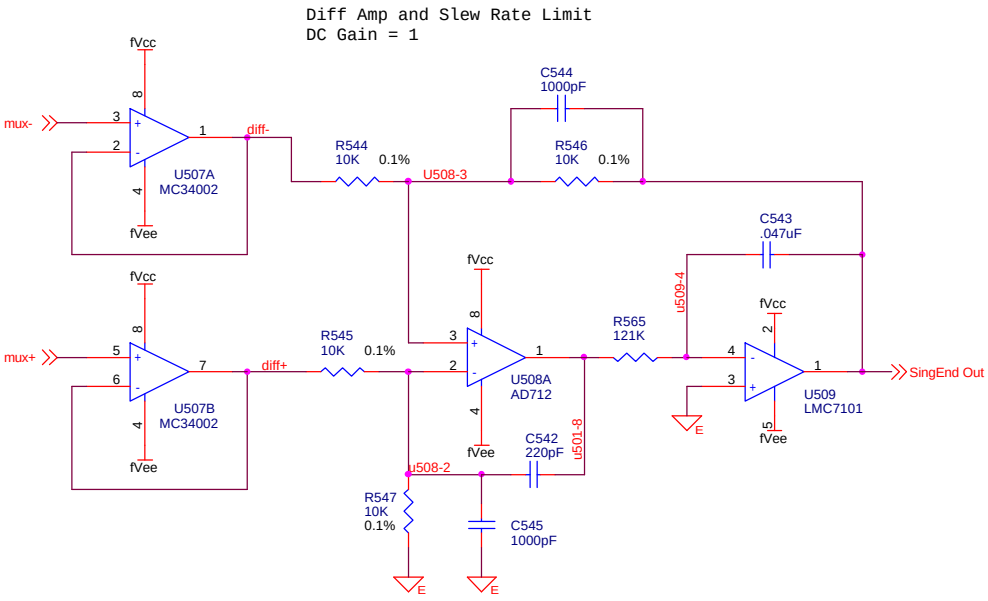
I	LA - RA
II	LL - RA
III	LL - LA
aVR	RA - 1/2*(LA + LL)
aVL	LA - 1/2*(RA + LL)
aVF	LL - 1/2*(LA + RA)
V	V - 1/3*(RA + LA + LL)

A resistor divider network (Wilson Network) is used to create the terms above. These vectors are then switched though the two Mux's, into the differential amplifier.



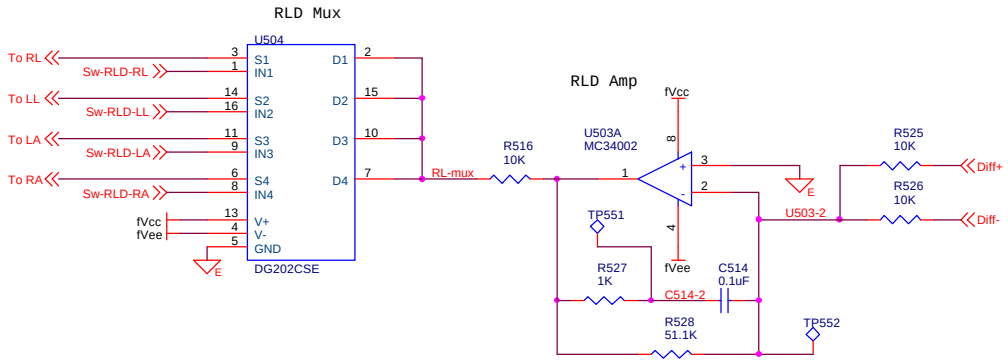
2.5.5 Differential Amplifier and Slew rate limit

A traditional 3-opamp gain stage (U507 and U508) is used to construct the differential amplifier. The topology is modified slightly with the addition of slew rate limiting (U509). The ECG signal is slew rate limited to about 100V/sec. This is done to minimize distortion of the ECG trace in the presence or large pace pulses. The differential outputs of this stage are used as input to the RLD amplifier.



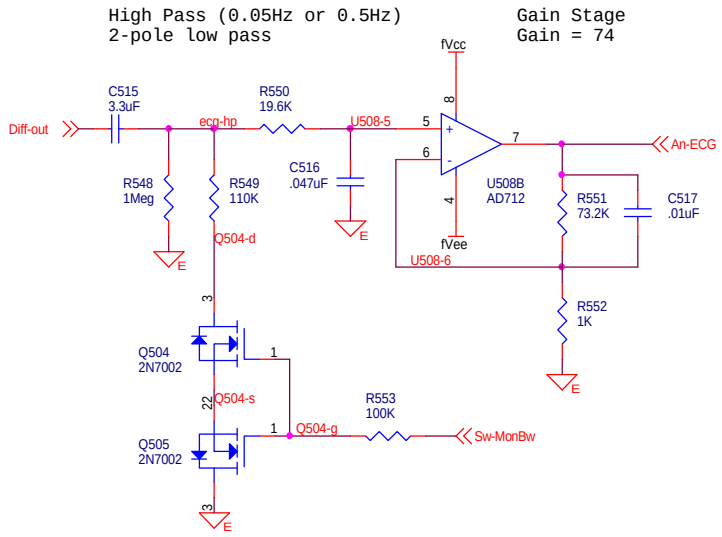
2.5.6 Right Leg Drive Amplifier

The right leg amplifier performs two functions. First is to provide bias current to the input buffer amplifiers. Second, to reduce 60Hz interference (increase CMR). Patient Common mode signals are amplified and inverted, and this resultant signal used to drive the patient. Gain of the RLD amplifier at 60Hz is maximized, while keeping the system gain stable. The RLD output is mux'd to the appropriate wire depending on the chosen input vector. For example, when looking at Lead I (LA-RA), the RLD signal is switched to the LL buffer.



2.5.7 High Pass and Gain Stage

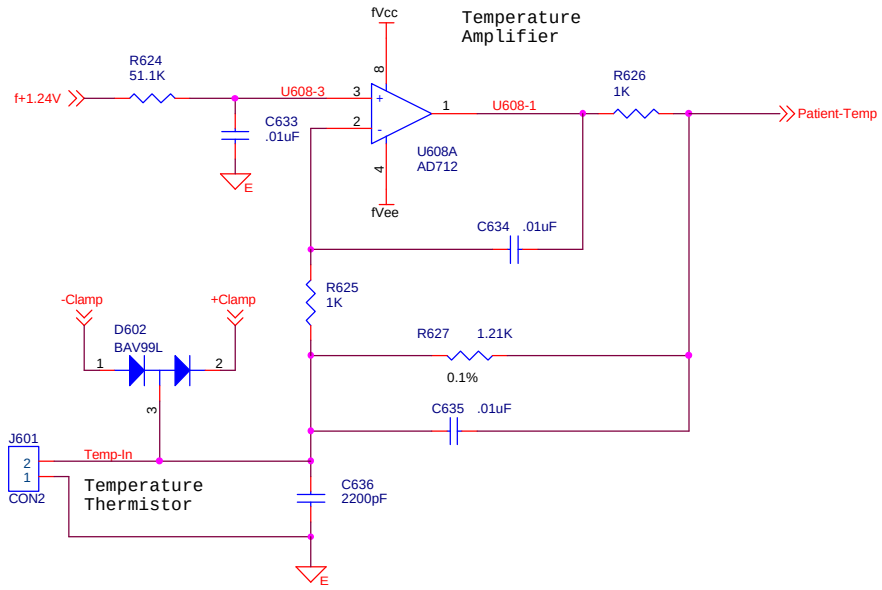
The signal from the output of the differential amplifier is AC coupled before a final stage of amplification. The High Pass Pole is set to less than 0.05Hz (a 3.3 second time constant). Large DC signals are sometimes present, for example, following a Leads Off condition. In order to quickly restore the baseline, a transistor switch (Q504,Q505) is used to change the AC pole time constant to 0.33 seconds. Op Amp U508 provides the final amplification prior to the A/D converter.



2.6 *Temperature Amplifier*

The temperature option of Atlas is designed to operate with YSI-400 series probes. This probe has a negative temperature coefficient, R@30C = 1815Ohms, R@40C = 1200Ohms. The temperature amplifier is configured as a non-inverting gain stage. The positive input to the amplifier is a 1.25V reference. The output of the temperature amplifier is V = Ref*(1+Rfb/Rthermistor).

The A/D converter will digitize the An-Temp input, along with the reference voltage and ground. The gain of the A/D can be calibrated from the reference voltage measurement, and any drifts in the reference voltage or A/D gain are compensated.



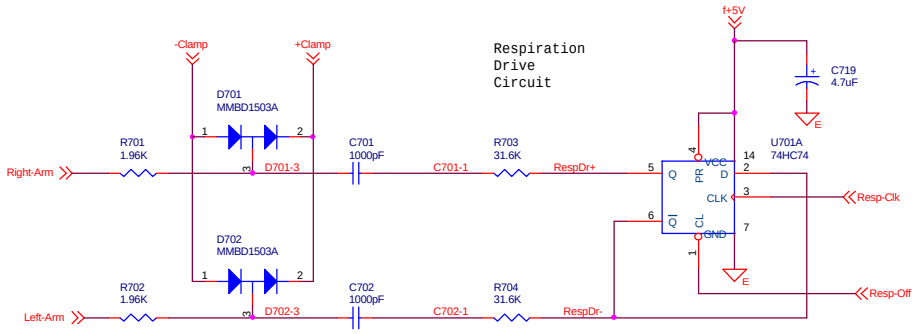
2.7 *Impedance Respiration*

2.7.1 Overview

Impedance respiration is accomplished by measuring a change of resistance across the patient's chest during breathing. The RA and LA electrodes (Lead I) are uses to acquire the respiration signal. A current source is driven through the patient, and the voltage developed across the patient is measured. The change in resistance caused by respiration is small, in the order of 1 Ohm. This small change must be measured on top of a large baseline impedance, typically 100 to 1000 Ohms.

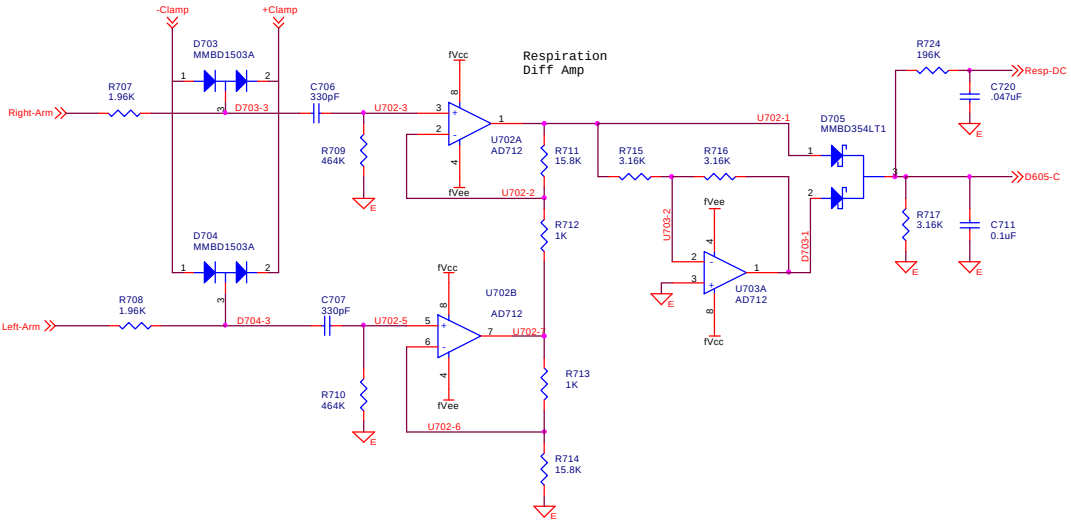
2.7.2 Signal Source – Current Drive

An AC current source is used as the input signal, a 34.8KHz square wave. The Power supply sync signal, at 76.8KHz, is transmitted across opto isolator U710. Flip Flop U701, configured as a divide by 2, converts this signal to a 34.8KHz. Current through the patient is about 150uA Pk-Pk, set by the output of U710 (5V) and the circuit series impedance, 69K including cable resistance. The impedance of the patient is small (<2K) compared to the series impedance and has minimal affect on the magnitude of the drive current. Diode clamps are used to protect the respiration circuits in the event of a Defibrillation pulse.



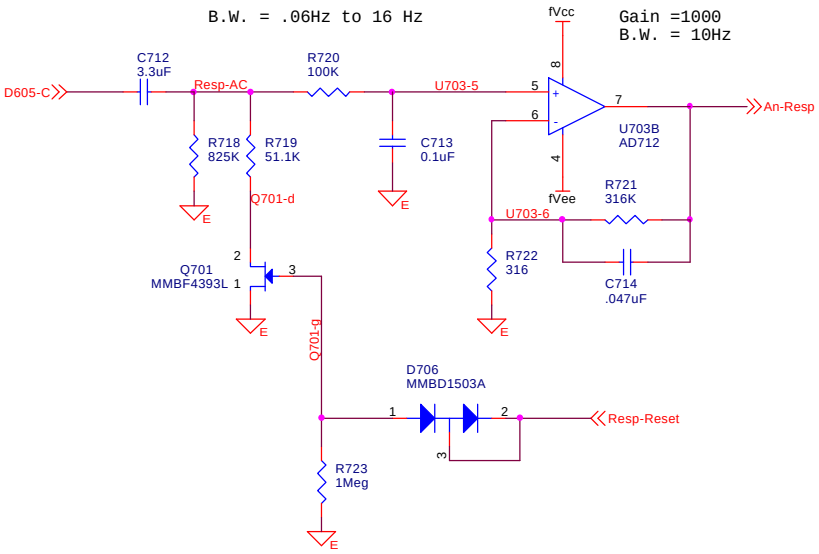
2.7.3 Differential Amplifier and Peak Detector

The AC current driven though the patient develops a voltage across the RA to LA electrodes. This signal is measured and amplified with the Differential Amplifier formed by U702A/B. This amplifier converts the differential voltage across the patient to single ended signal, with a gain of 16.8. Inverting this signal (U703A), and summing the original signal and inverted signal through the dual Diode D705 then forms a synchronous peak detector. Then, the voltage on C711 is the DC resistance seen across the RA to LA buffer. This baseline resistance is digitized, and if the signal is too large (>2.5K), a Respiration Lead Fault message is displayed. Note that this circuit measurement includes the two 1K resistors in the EKG cable set. This 2K resistance is subtracted in software before determining a leads off condition.



2.7.4 Gain and Filtering

The DC content (baseline resistance) of the respiration signal is not needed, so the signal is next AC coupled, and additional gain applied before digitization. Low pass filtering is performed at this stage to reduce high frequency noise outside the respiration signal bandwidth. A baseline-reset circuit (transistor switch Q701) is used to quickly restore the high pass pole if excessive DC voltage is present, for example following a Leads-Off condition.



2.8 *SpO2 Circuits*

The SpO2 transducer senses oxygen content of functional arteriolar hemoglobin through the use of light (red and infrared) passed through the sensor. The reflective characteristics of hemoglobin at the wavelengths used allow the pulse oximetry circuits to obtain changing saturation levels. This data is then processed to obtain the oxygen saturation percentage and pulse rate.

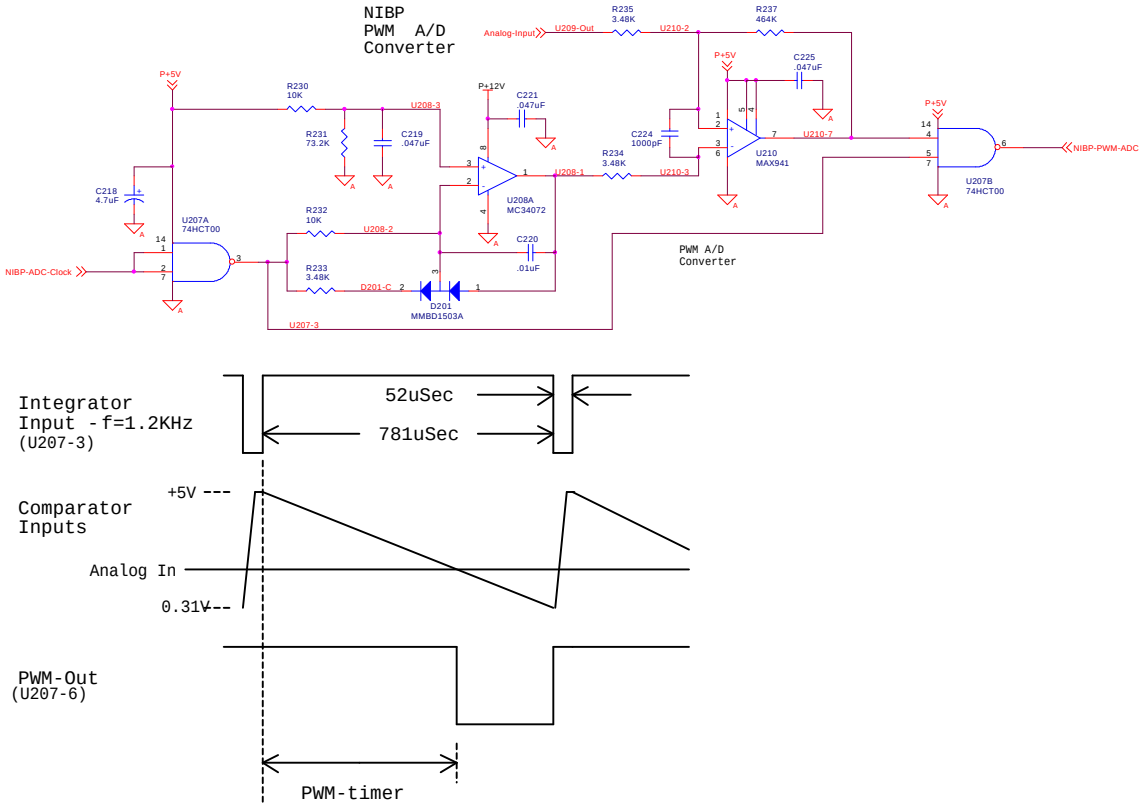
Nellcor or Nonin Medical provides the SpO2 board (Nonin only for the model 621). The SpO2 board includes amplifiers and processing, and transmits serial data to the CPU board (Waveform data, SpO2%, and pulse rate). The Atlas monitor provides electrical isolation (power and data) for the SpO2 board. Note that you must use Nonin probes with the Nonin SpO2 board, and Nellcor probes with Nellcor SpO2 board.

3 Non-Isolated circuits - A/D and Mux

3.1 *A/D – grounded circuits*

The A/D converter is designed by building a pulse width modulator (PWM) and a timer circuit. The PWM runs at a 1.2KHz rate, synchronized by the A/D sync signal (NIBP-ADC-Clock). A/D sync is low for 52.1uSec, high for 781.25uSec. Component values are selected such that the integrator will ramp down 4.7V, and ramp up 7.83V. The voltage at the integrator output (U601-1) is limited to about 5V [5V*(73.2/83.2) + Vdiode)]. Then, the integrator starts at 5V and ramps linearly down to 0.3V.

The analog input voltage to be digitized and the integrator output are the inputs to comparator U210. The output of the comparator is low at the start of an A/D cycle, and switches high as the integrator ramp drops below the input voltage being digitized (see the timing diagram below). A/D conversion is accomplished by measuring the width of the PWM output signal. The A/D timer runs at 25.175MHz, then the A/D resolution is about 21000 counts (over 14 bits). Note that since the output of the comparator is low at the start of the A/D cycle, a resistor divider is formed at the comparator input. This divider reduces the Analog-In signal by 0.75% [464K/(464K+3.48K)].



3.2 *A/D Mux – grounded circuits*

Analog signals are switched to the A/D converter through MUX U209. Control of the multiplexer is through a serial communication channel from the main CPU. The following signals are digitized:

12. +5V/2	Sampled version of the 5V supply. Used to verify A/D operation.
13. SafetyPres	Safety Pressure Transducer
14. PrimaryPres	Primary Pressure Transducer
15. P.75V	Reference voltage for A/D calibration. 0mmHg pressure for Primary Transducer.
16. P4.25V	Reference voltage for A/D calibration. 300mmHg pressure for Primary Transducer.
17. Print-Temp	Printhead Temperature, used to compensate printer strobe width.
18. BattVoltage	Battery Voltage, used to warn of low battery condition.
19. BattCurrent:	Battery Charger Current, used only in service mode verification.

4 NIBP Circuits

4.1 *Overview - Safety:*

Two pressure transducers are used, a primary and safety transducer. The primary is used to make all BP measurements. Hardware circuits monitor the output of the primary transducer, looking for overpressure faults. In addition, Software monitors the digitized outputs of the primary transducer, and detects overpressure faults. The following overpressure faults are detected in software (monitored once per second):

1. >=10mmHg pressure for 295 seconds
2. >=15mmHg pressure for 175 seconds
3. >295mmHg pressure for 0.5 seconds.

Software detected overpressure faults are considered application faults. The user is warned of a fault with an audible alarm and a 'Check blood pressure cuff' message on the CRT display. NIBP is not disabled for this type of fault. In the event of a fault, the drive signals to the NIBP pump and valve are opened.

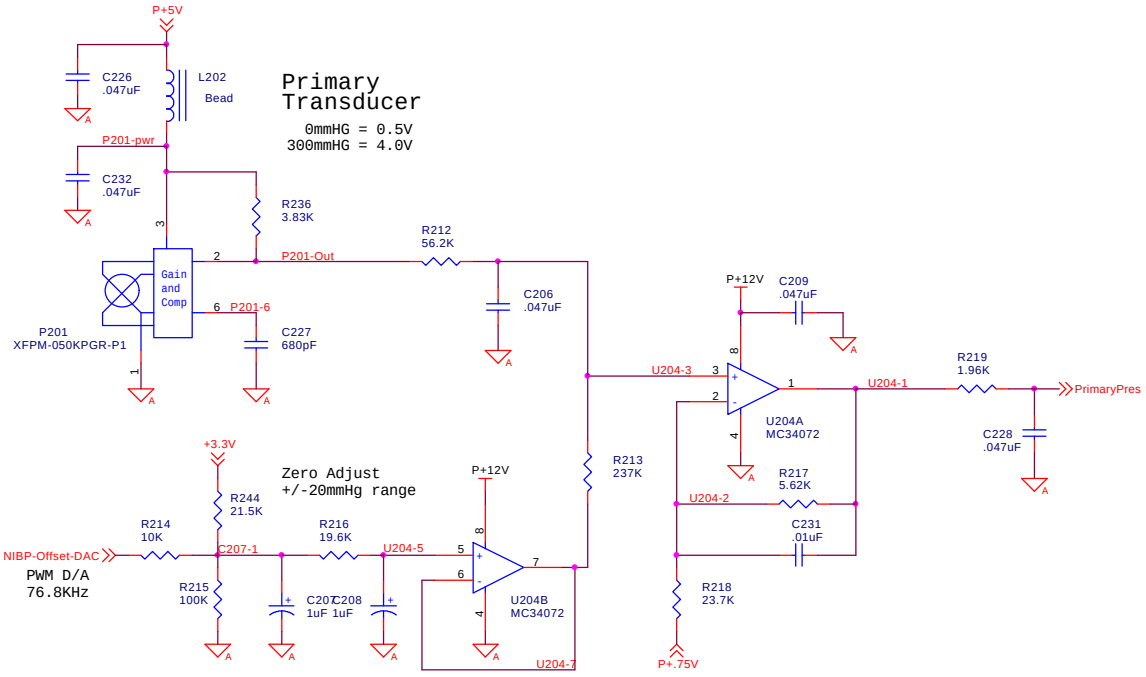
Two hardware faults are detected, pressure over 330mmHg (nominal trip point 314mmHg, and pressure over 15mmHg for three minutes (13.3mmHg nominal trip point). These faults are considered more serious (since software should have detected and corrected this condition). The user is notified with a 'BP SYSTEM FAULT' message, and NIBP is disabled. A redundant safety transistor is opened to ensure the NIBP pump is off and the valve is open.

The primary and safety transducer outputs are continuously digitized. The outputs of the transducers are checked vs. each other, and if they disagree, an 'NIBP Fault Message' is declared and the NIBP system is disabled. The outputs of the transducers are linearly proportional to the supply voltage (supply current for the safety transducer). The transducers use unique reference voltages to ensure that a fault in one reference will not cause an equivalent gain error in both transducers.

The A/D also has redundant checks. Two reference voltages (derived from the primary transducer reference supply) are measured, and the A/D gain and zero is checked. In addition, a unique reference is digitized, and compared vs. expected results. An error in any of these A/D measurements will again cause an 'NIBP Fault Message', and the NIBP system will be disabled.

4.2 *Primary Transducer - Amplifier:*

The primary pressure transducer is a fully calibrated and compensated transducer with built in voltage amplification. The output of the transducer is proportional to the supply voltage. With a 5V supply, the output of the transducer is:
0mmHg = 0.5V.
300mmHg = 4V.
Op amp U204A is used to level shift the output of the transducer such that the nominal voltage for 0mmHg is set to 0.75V. The CPU monitors the digitized zero pressure voltage, and any offset is corrected. This correction comes from the summation of an error correction signal through op amp U204B. The CPU will output a pulse width modulated signal at 76.8KHz. This signal is RC filtered to provide ad DC voltage at U204-5. This signal can adjust the offset seen at the A/D converter by +/-20mmHg.



4.3 *Safety Transducer - Amplifier*

The safety transducer is compensated for temperature drift, but gain and zero are not calibrated. The safety transducer does not include built in voltage amplification. The safety transducer output is a differential voltage, proportional to the supply current through the device.

The initial accuracy of the safety transducer is very loose, in the order of +/-50%. However, the drift over time and temperature is very good. Then, it is necessary to calibrate the output of the safety transducer. This is done my measuring a know pressure, measuring the output of the safety transducer, and storing calibration constants in NVRAM. A two-point calibration procedure is used. Calibration is done at the factory, and can be recalibrated in the field if necessary.

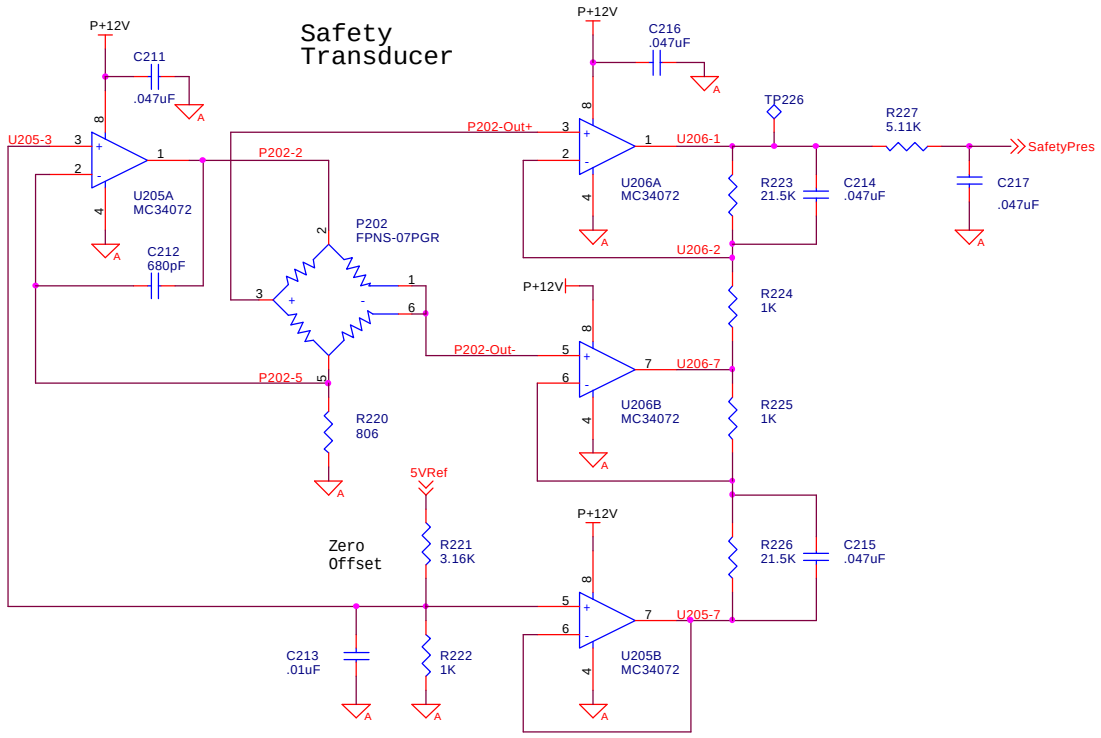
4.3.1 Current Source:

Op amp U205A is configured as a current source for the Pressure Transducer, with the current through the transducer set to 1.5mA. Nominal gain for the transducer is 300mmHg = 75mV.

4.3.2 Differential Amplifier and Offset Centering:

The output of the safety transducer is a differential voltage, with a nominal gain of 0.25mV/mmHg, and a zero pressure offset voltage of +/-25mV. The A/D converter has an input voltage range of 0.5V to 5V. It is necessary to both add both signal gain and offset centering to the transducer output before digitization.

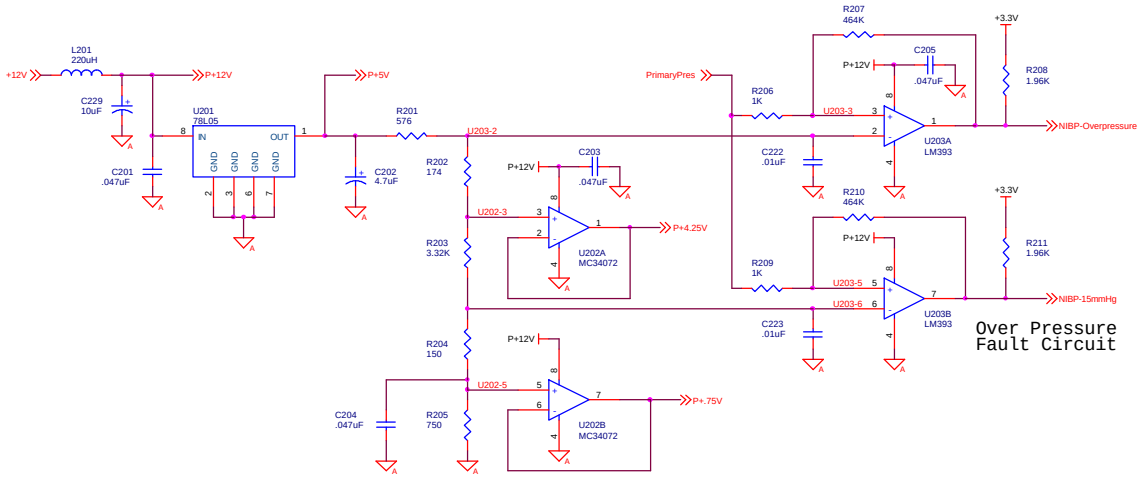
Op amp U206A/B is configured as a differential amplifier, with a voltage gain of 22.5. The output of the differential amplifier is offset by 1.2V (U205B).



4.4 *Hardware Overpressure:*

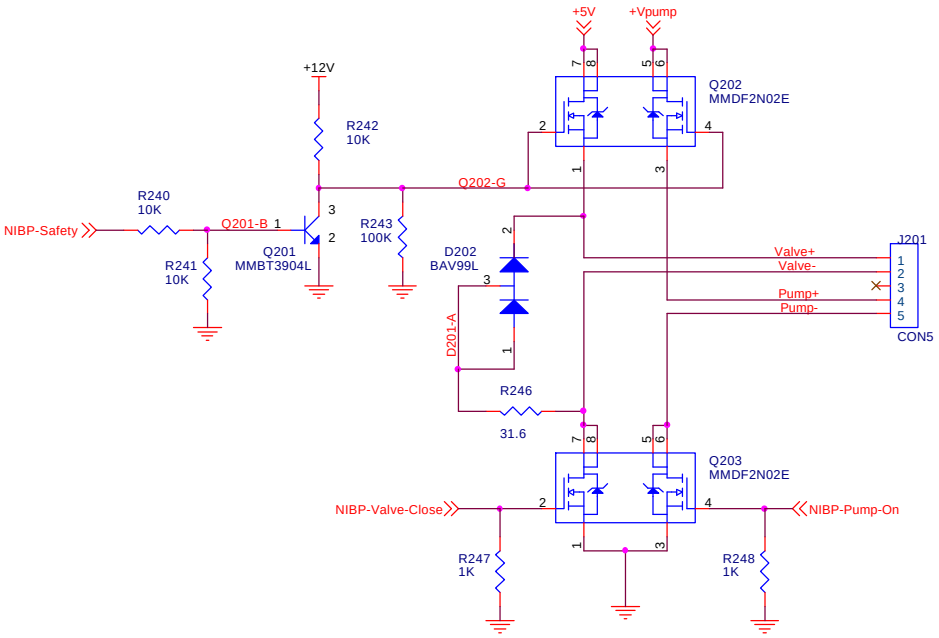
The output of the primary transducer is monitored for two overpressure conditions; pressures in excess of 13.3mmHg (nominal) and 314mmHg (nominal) are detected. These error conditions are transmitted to the gate array on the CPU board, and if the error conditions are present for a long enough time period, a fault message is displayed, and NIBP is disabled (see above for safety performance operation).

The output of the Primary Transducer drives the two comparators U203A/B. The comparison voltage is derived through a resistor divider chain from a 5V regulator (U201). This regulator is the supply voltage for the primary transducer, and sense the primary output is proportional to the supply voltage, tolerance errors in the regulator are not critical.



4.5 *Pump and Relay Drive:*

Two independent dual transistor switches, Q202 and Q203 control the pump and valve. Q202 is controlled by logic circuits on the CPU board, and is normally in the on state. Q202 is only opened in a fault condition (over pressure, A/D calibration error, or transducer mismatch). Once a fault is detected, Q202 will remain open until power is cycled. Under normal operation, dual transistor Q203 is used to switch the pump on and close the valve. The pump-on and valve-close commands are controlled by software. Note that the valve is normally open. Then, in the case of no power, the valve will be in the open state.



5 CRT Deflection Board

5.1 *Overview:*

Atlas uses a 5-inch monochrome CRT display. This CRT will display Waveform Data (ECG and Respiration or SpO2 or$ETCO_2$), plus Text Data (Heart Rate, Alarm Values, Trend Data, setup, and service menus). The CRT Deflection board performs the following functions:

1. Vertical Deflection.
2. Horizontal Deflection.
3. CRT Grid Voltages.
4. Video Amplifier.

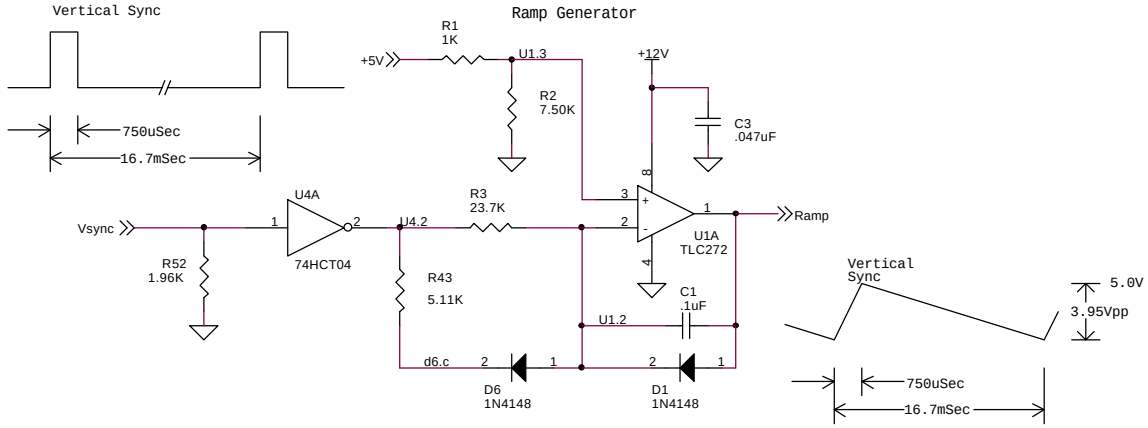
CRT Deflection is magnetic, vertical and horizontal deflection is controlled by regulating current through the vertical and horizontal coils of the CRT Yoke. The Deflection board is designed to the following specifications:

Resolution:	VGA (640X480)	
	Dot Clock:	39.7nSec (1/25.175Mhz)
	Display Size:	100mm (Horizontal) X 68mm (Vertical)
Vertical:	Scan Rate:	60Hz
	Reset Time:	750uSec

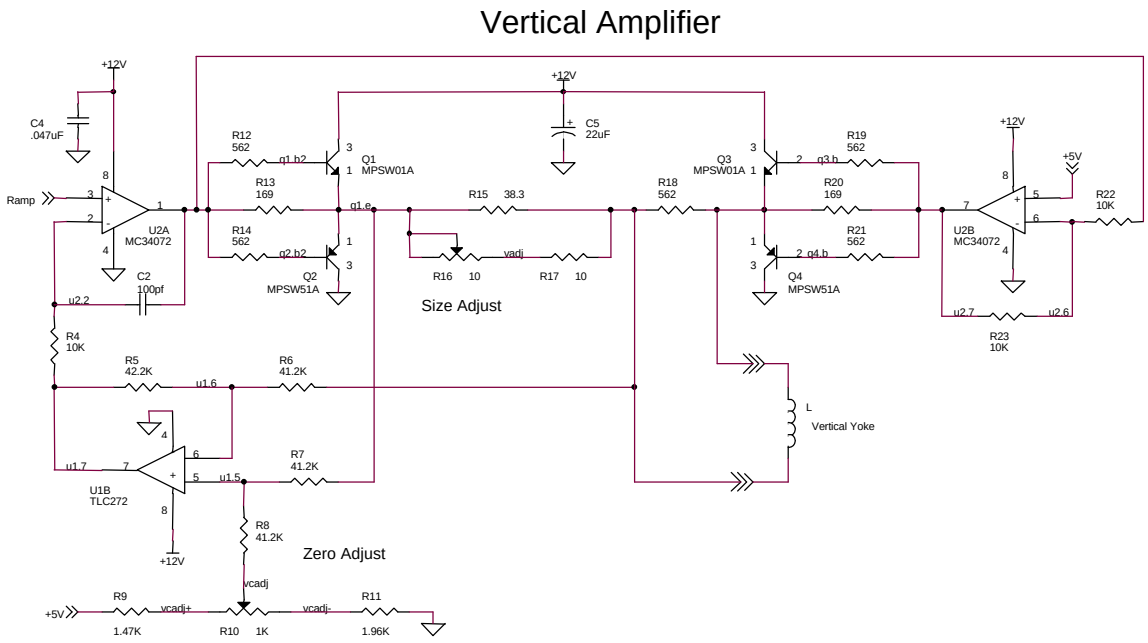
	Blanking Time:	1.2mSec
Horizontal:	Scan Rate:	31.5Khz
	Reset Time:	5uSec
	Blanking Time:	5.7uSec

5.2 *Vertical Amplifier:*

5.2.1 Ramp Generator:



A ramp generator is built from the integrator (U1A, C1, and R3). The slope of the integrator is: V = (I*T)/C. The integrator is designed so that it ramps up 6.97V in 750uS and ramps down 3.95V in 15.9mS. Diode D1 clips the output voltage at about 5.0V (U1-pin3 + Vdiode). Then the ramp resets at 5.0V each cycle, and integrates down 3.95V.



5.2.2 Vertical Amplifier:

The Vertical amplifier will generate a linear current ramp of +/-200mA. The vertical amplifier is an H-Bridge type driver. Positive current flow (deflecting the beam above the centerline) is defined as current from +12V to Q1 to Rsense through the coil to Q4 to Ground. The negative current path is from +12V to Q3 through the Coil to Rsense to Q2 to Ground.

The input to the vertical amplifier is the ramp voltage generated above. The objective of the vertical amp is to match the current through the vertical coil with the input ramp control voltage. Current through the vertical coil is monitored through the sense resistor, formed from R15, R16, and R17. Voltage across the sense resistor is measured with the differential amplifier U1B. This voltage is then used as the feedback voltage to the control opamp, U2A.

5.2.3 Zero Adjust:

The output voltage from the ramp generator is a ramp from 5.0V to 1.05V (nominal). The center of this ramp is 3.0V. Then, the output of the current sense diff amp must be offset by 3.0V. This is accomplished with the Zero Adjust Network, Resistors R9, R10, and R11. Vertical centering is then accomplished by writing a pattern to the CRT, and adjusting R10 to center the display.

Size Adjust:

Adjusting the current through the Vertical Coil changes vertical deflection. The voltage across the sense resistor is:

Vsense = (Vramp-Voffset) / 1.02 (1.02 is the gain of the current sense diff amp)

Current through the coil is equal to current through the sense resistor network.

Icoil = Isense = Vsense / Rsense

Then, adjusting the value of the sense resistor will change the current through the vertical coil. Vertical gain is then accomplished by writing a pattern to the CRT, and adjusting R16 to set vertical deflection.

5.3 ***Horizontal Amplifier:***

Current through the transformer increases linearly as Transistor Q6 is On (I = VdT/L). When the transistor opens, the drain voltage kicks up, and the current through the Transformer coil flows through C9, L2, L3, and the Horizontal Coil to Ground The transformer quickly loses flux (reset time < 5uSec). Current continues to flow in load inductance, from Ground through Q6-diode, C9, L2, L3, and the Horizontal Coil to Ground. This current flow charges capacitor C9. The current decreases linearly to 0, then changes directions. This is due to the AC coupling capacitor C9 being charged to a negative voltage. Current flow is then from Ground through the Horizontal Coil, L2, L3, C9, and Q6 to Ground.

The drive to MOSFET Q6 is AC coupled. This will prevent Q6 to be driven high in the event of a faulty driver on the CPU board.

In order to get adequate deflection current (about +/-2.3Amps), 18.5V across the transformer coil is necessary. A “boost” winding is added to the transformer, then when the voltage on the transistor drain flys up, current flows into capacitor C11. C11 charges to a voltage determined by the turns ratio in the transformer.

5.3.1 Horizontal Gain:

Horizontal deflection is adjusted by changing the current through the Horizontal coil. Changing the series inductance in the Horizontal Deflection Path modifies the current. Increasing Horizontal gain is then accomplished by writing a pattern to the CRT, and adjusting the “width coil”, L3.

Horizontal Centering:

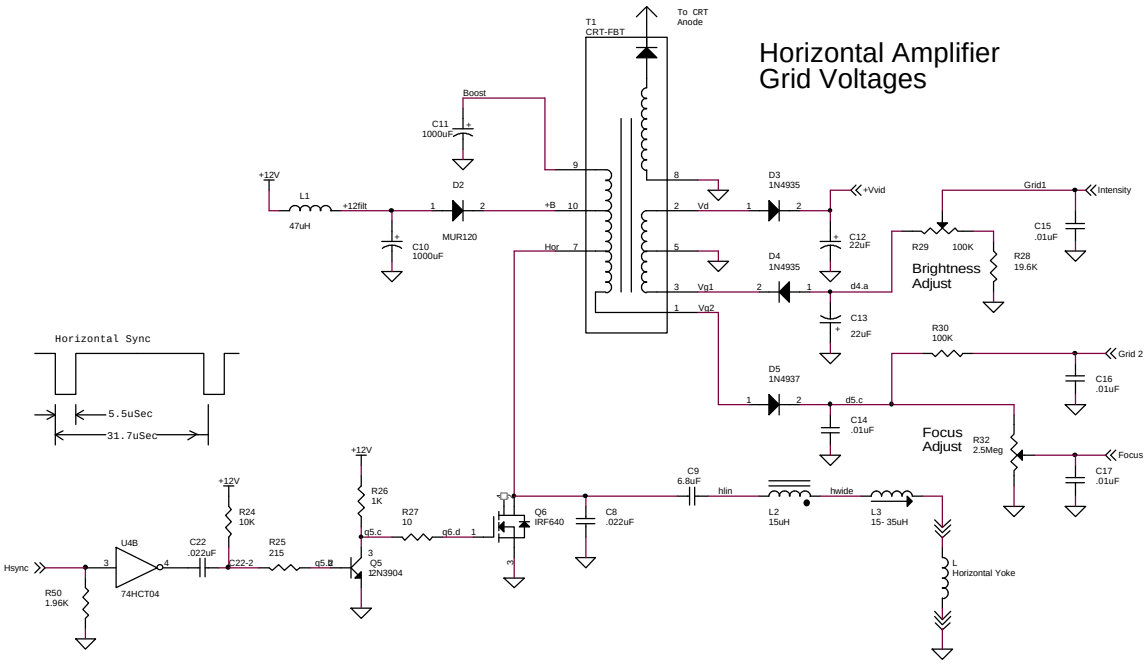
Horizontal centering is accomplished by rotating magnets mounted on the CRT Yoke assembly.

5.3.2 Grid Voltages:

The following voltages are developed to bias the grids on the CRT:

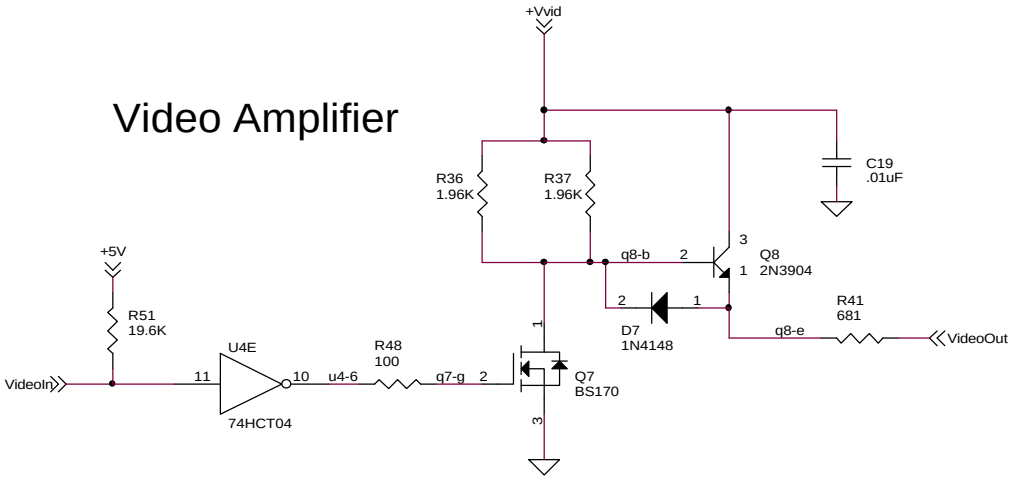
Grid 1: -10V to -50V DC (Brightness Adjust)
Grid 2: 350VDC
Grid 4: 0V to 350VDC (Focus Adjust)
Anode: 7.5KV

These voltages are derived from additional windings on the FBT. In addition, the supply voltage for the video amplifier (+36VDC) is generated from a tap on the FBT.



5.4 *Video Amplifier:*

The CRT tube turns a dot on when video out is low (near 0V), and off when video out is high (+Vvid = 28V). The input to the video amplifier is a digital signal (3.3V logic level) from the uProcessor. An input of 0V turns the dot off, an input of 3.3V turns the dot on. Transistor Q7 amplifies and inverts this signal. Video out is driven low through D7, and driven high through emitter follower Q8. .



6 Recorder Electronics

6.1 *Overview:*

Atlas includes a thermal strip chart printer (optional on Model 200 and 210, standard on model 220). The user can print either annotated waveform data or Patient trend information.

The printer specifications are:

Paper Size:	56 or 58mm	(2 1/4 inches)
Printhead Width:	54mm	(2 1/8 inches)
Resolution:	Vertical: 8 dots/mm,	(200 dots/inch)
	Horizontal: 12 dots/mm	(300 dots/inch)
Chart Speed:	25mm/sec	(1 inch/second)

The main CPU controls the printer. Data timing, clock signals, and strobe widths are all generated by the FPGA on the CPU board. These signals are buffered on the recorder board (inverter U5), before transmission to the printhead.

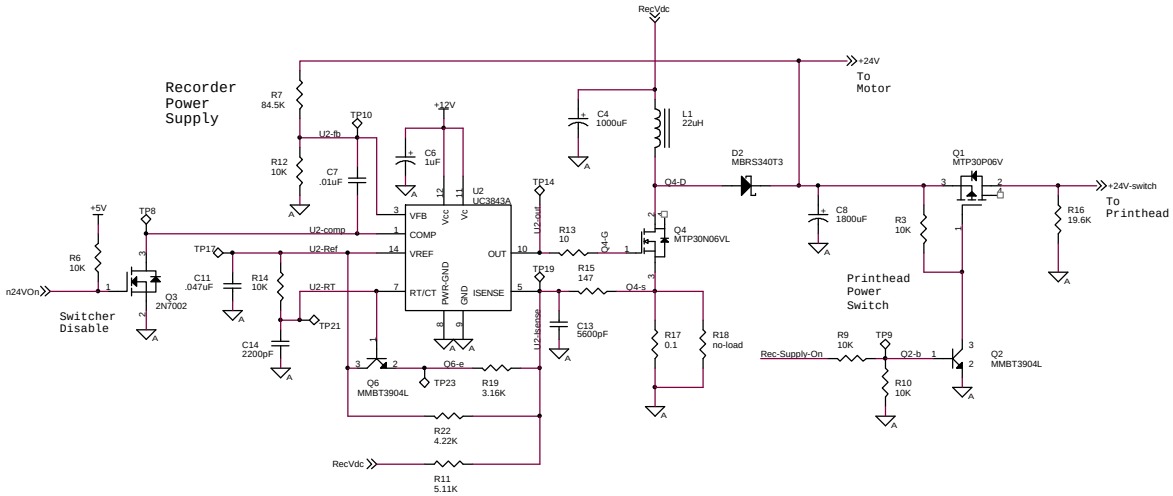
6.2 *Power Supply – 24 Switcher*

It is necessary to generate 24VDC for the print head and motor. The input to the 24V switcher is either 12V from the AC/DC converter, or Battery voltage on the model 210/220 when AC is not present. The circuit is configured as a boost PWM using current mode feedback. The PWM controller is a UC3843A. The controller includes an internal 2.5V, 1% reference, and an external 5V, 1% reference. Nominal output voltage for the boost converter is Vout = [2.5V*(1 + 84.5K/10K)] = 23.6V.

The converter will run at duty cycles over 50%, which requires slope compensation for a current mode controller. Slope compensation is added by summing in part of the oscillator signal with the current sense line.

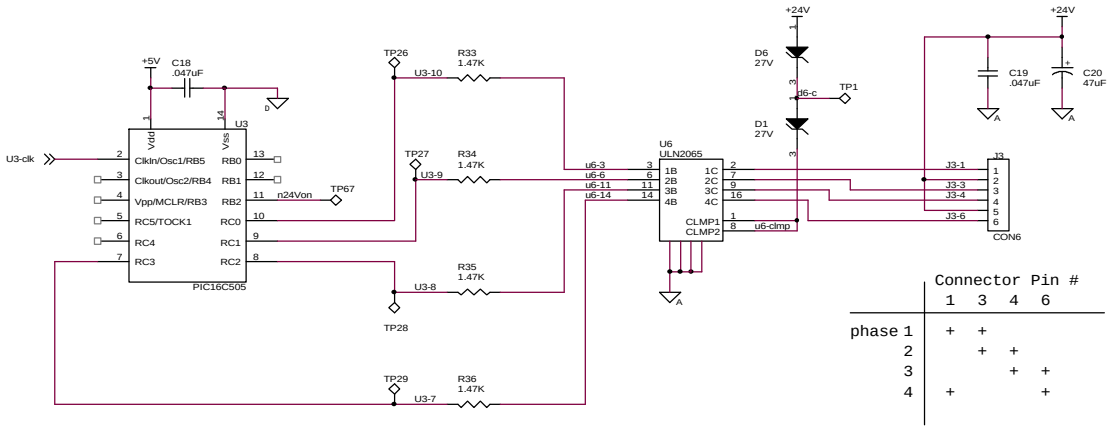
The PWM current limits on a cycle to cycle basis. The supply will be in current limit when the Isense line reaches 1V. Current limit is set to about 3.5 Amps from 12VDC or 5Amps from battery.

Two control signals exist for the 24V switcher, n24Von and Rec-Supply-On. The 24V switcher is disabled when n24Von is high. This signal is controlled by the on board PIC processor. The switcher is held off at power up, and allowed to start after 50mSec. This is done to reduce inrush current at power up. The signal Rec-Supply-On enables power to the print head, and is controlled by the main CPU. Power is only applied to the print head when the recorder is running.



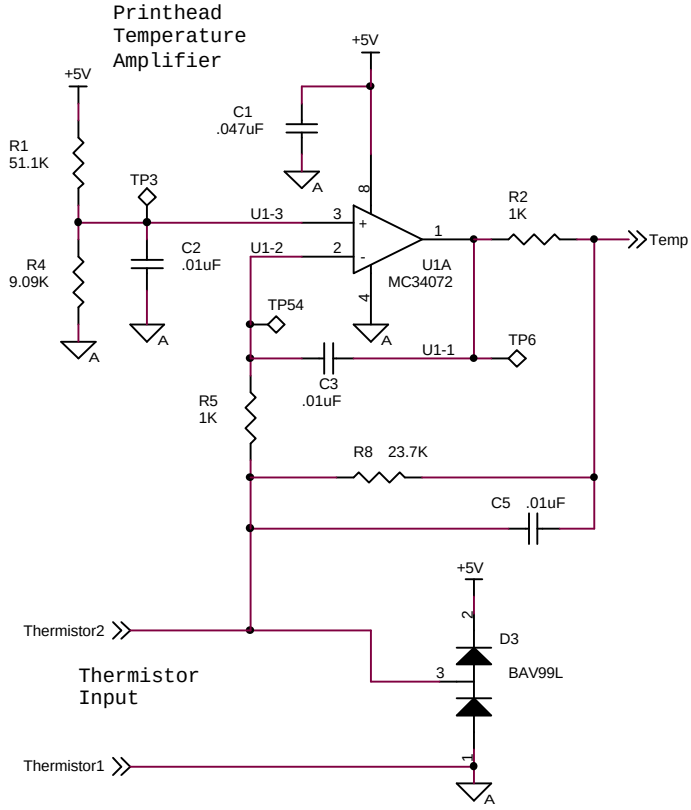
6.3 *Motor Driver:*

Atlas uses a stepper motor to drive the paper. The microcontroller (U3) is programmed to apply the appropriate phased signal to the motor. A quad darlington switch (U6) amplifies the signal from the controller to signal levels needed to drive the motor. Motor speed timing is derived from the main CPU, and transmitted to U3 on signal line U3-clk (U2-pin2).



6.4 ***Temperature Amplifier:***

The printer will print darker as temperature is increased. Print darkness can adjusted by controlling the time a dot is turned on. A thermistor is included on the printhead. This thermistor is nominally 30K, and decreases as temperature increases. The output of the temperature amplifier is a function of the thermistor voltage, Temp = .755*(1+R8/Rtherm). This voltage is digitized (on the main board), and the CPU can compensate dot width in order to maintain consistent printing over temperature.



Atlas Repair Parts

Part Number	Description
6200-43E	SERVICE MANUAL
620001-501	MAIN PCB ASSY - LOW END
620004-501	ATLAS CPU PCB ASSY
620007-501	FRONT PANEL DISPLAY PCB ASSY
620013-501	PRINTER PCB
620016-501	MAIN PCB ASSY - MID/HIGH END
620032	ETCO2 PCB ASSY
620034	ETCO2 CONNECTOR & CABLE
620035	NELLCOR SPO2 BD
620038	NELLCOR LABEL (CARTON)
620105-1	BATTERY DOOR
620117	PRINTER DOOR BUTTON
620119	LATCH SPO2
620125-501	MAIN CASE/HANDLE SET
620126-6	BEZEL SET/HIGH HEAT TRANSFER
620127	METAL BRACKET FOR PRINT
620131-1	MAIN FOAM
620132-2	TOP FOAM
620133	BP FOAM
620134-501	GEAR ASSY
620138-501	PRINTER DOOR ASSY
620139-501	PRINTER FRAME ASSE
620140-501	MAIN PRINTER ASSY
620141	METAL HOUSING - TOP
620142-1	METAL HOUSING-BOTTOM (LG)
620143	NUT TEMPERATURE
620144	BRACKET SPO2
620148	GASKET CO2 EXHAUST
620149	FITTING,1/16 X 1/8-27 NPT
620150-1	AC/DC POWER SUPPLY
620159	PRINT HEAD
620165	CABLE-CONN TO MAIN BD,ECG
620167	CABLE-MAIN BD TO DISPLAY BD
620168-1	CABLE ASSY POWER SUPPLY
620169-2	CABLE ASSY NELLCOR SENSOR
620170	CABLE ASSY NELLCOR
620171	CABLE ASSY SPEAKER
620172-2	CABLE ASSY AC
620173	CABLE-TEMP SENSOR TO MAIN
620175	CABLE ASSY - FAN
620176	CABLE ASSY - PRINTER
620177	CABLE ASSY - PRINT HEAD
620178	CABLE ASSY SP02
620182	LABEL - RS232
620187-501	PNEUMATIC SUB ASSY
620189	4-20 X 5/16 SLT/TORX PN PL ZIN
620192	PNEUMATIC CONNECTOR (MACH)
620193	NUT, HEX 5/16-32 X.095 PNEUM
620194	WASHER,FLT.33 X.62 X.049
620197	BUSHING, SPLIT NYLON
620198	FOOT
620200-501	CRT SUB ASY

Atlas Repair Parts

Part Number	Description
620201-501	POWER SUPPLY ASSY (LOW END)
620201-502	POWER SUPPLY ASSY W/FAN
620202-504	MAIN HSG ASSY W/BATT & PRNTR
620205	4-40 X .31 TX PN MC ST ZN
620207	NUT, M3-.5 HEX KEPS ST ZN
620373-501	NONIN SUB ASSEMBLY
620377-1	"NELLCOR WORKS HERE" LABEL
620377-2	NELLCOR PATENT LABEL
620378-1	ATLAS KEYPAD
620378-2	ATLAS KEYPAD
620378-3	ATLAS KEYPAD
620378-4	ATLAS KEYPAD
620378-5	ATLAS KEYPAD
620378-6	ATLAS KEYPAD
620379-501	MONITOR BOX W/INSERTS
620385	SUB-LABEL DISPLAY
620386	FASTON TAB
620387	SHUNT
620388-1	LABEL, NONIN SENSOR
620388-2	LABEL, NELLCOR SENSOR
620393	PWR SUPPLY INSULATOR LABEL
620394-1	WASHER, SHOULDER PLATED
620395-501	REPLACEMENT LAMP SUB-ASSY.
620402	SPACER, DOOR
620403	FLAT TIE HOLDER
620524	CABLE-CO2 TO MAIN BD
761077-1	TIE WRAP

REV	DESCRIPTION	ECN/ECO	INIT	DATE	CKD
X3	RELEASE TO PRODUCTION	-	-	-	-

PRINT HEAD
Ground
+24V-SWITCH
+24V-SWITCH
THERMISTOR-1
THERMISTOR-2
STROBE
GROUND
GROUND
GROUND
+5V
STROBE
LATCH
CLOCK
DATA
+24V-SWITCH
+24V-SWITCH
GRN
ALL YELLOW
CABLE ASSEMBLY
PRINT HEAD
J2
P2
RECORDER BOARD
MOTOR
PHASE 1
+24V
PHASE 2
PHASE 3
+24V
PHASE 4
Ground
J3
P3
BLK
RED
BRN
YEL
RED
ORN
STEPPER MOTOR
CABLE ASSY
MOTOR ESD GROUND
TO POWER
SUPPLY CAN
CABLE ASSY
PRINTHEAD ESD GROUND
TO POWER
SUPPLY CAN
PRC-WRKG
Rec-Supply-On
Not Connected
Rec-Motor-Step
+5V
+12V
Rec-Data-Latch
Rec-Strobe
Rec-Clock
Rec-Data
Ground
Ground
Rec+5CV
Rec+5CV
Rec+5CV
Rec+5CV
Rec+5CV
Rec+5CV
Rec-Gnd
Rec-Gnd
Rec-Gnd
Rec-Gnd
Rec-Gnd
CABLE ASSY
PRINTER
CABLE ASSY
DISPLAY
RIBBON CABLE
+5V
KEY-CLOCK
ON/OFF-KEY
KEY-LATCH-N
+5V
KEY-DATA
GROUND
LED-DATA
ACON-LED
LED-ON
GROUND
GROUND
LED-LATCH-N
DISPLAY BOARD
5 POSITION JUMPER
P2
J2
TREND
LEAD-SELECT
PRINT
ACON-LED
GROUND
DISPLAY BOARD 2
YOKE
YOKE AND CABLE ASSY
ANODE
6 POSITION JUMPER
P3
J3
INTENSITY
+12V
VIDEO
GROUND
GRID 2
FOCUS
P2
J2
HORIZONTAL -
HORIZONTAL +
TUBE GROUND
VERTICAL +
VERTICAL -
RED
YEL
BLK
ORN
GRN
DEFLECTION BOARD
BATTERY
BLK
FUSE
RED
RED
CABLE ASSY
BATTERY
CABLE ASSY
FAN
FAN
FERRITE
IN-LINE FUSE
POWER SUPPLY
L
N
GND
BLK
WHT
GRN
YEL
A/C
RECEPTICLE
GND ATTACHED
TO PCA WITH
FASTON
AC1-12V
AC1-12V
AC1-12V
GROUND
GROUND
GROUND
RED
RED
RED
BLK
BLK
BLK
GND
ATTACHED TO PS CAN
WITH SCREW
CABLE ASSY
AC RECEPTACLE
CPU BOARD
FERRITE
J10
Model 'LOW'
VIC
VIC
+5V
GROUND
RX
TX
VIC
VIC
MODEL MED/HIGH
P2
BATTERY
BATT+ID
GROUND
RED
BLK
BLK
CABLE ASSY
CO2
FERRITE
ETCO2-TX(TO J4-19)
ETCO2-RX(TO J4-17)
GROUND
+12V
CO2 BOARD
WATER TRAP SWITCH
GROUND
CO2
RECEIVER
ETCO2 CONNECTOR
WITH SWITCH
CABLE ASSY
NELCOR
RIBBON CABLE
P402
J402
P403
J403
P401
J401
SPO2 NELCOR BOARD
SPO2-RESET
+5V
SSIO2-Tx
SSIO2-Rx
+5V-3V
ISO+5V/9V
ANODE (DETECTOR)
CATHODE (EXT.SHIELD)
GROUND (RCAL return)
RCAL
+LED
-LED
MIC
CABLE ASSY
NELLCOR SENSOR
FERRITE
SPO2 NELLCOR CONNECTOR
CABLE ASSY
NONIN
SPO2 NONIN BOARD
CABLE ASSY
SPO2 ESD GROUND
GND
ATTACHED TO SPO2 BRACKET
WITH SCREW
CABLE ASSY
NONIN SENSOR
SPO2 NONIN CONNECTOR
P501
J501
RIGHT-ARM
LEFT-ARM
LEFT-LEG
GROUND
V-LEAD
RIGHT-LEG
WHT
BLK
RED
BLU
BRN
GRN
ECG
CABLE ASSY
ECG
P601
J601
TEMP-IN
GROUND
YEL
ORN
TEMP
CABLE ASSY
TEMPERATURE CONNECTOR
P4
J4
GROUNF
EKG-PWM-ADC
NIBP-SAFETY
GROUNF
+3.3V
NIBP-PWM-ADC
+3.3V
GROUND
GROUND
RS232-TX
NIBP-OVERPRESSURE
PIC-DATA
GROUND
RS232-RX
ETCO2-TX
SPO2-TX
ETCO2-RX
SPO2-RX
SPARE-2-NC
ADC-CLOCK
NIBP-DATA
RE-CLOCK
NIBP-16mmHg
SPI-DATA-OUT
SPI-CLOCK
VIDEO-HSYNC
BATT-ID
SPARE-3-NC
RE-DATA
POWER-SYNC
REC-MOTOR-STEP
VBACKUP
VIDEO-VSYNC
PIC-CLK
VIDEO-VSYNC
SPEAKER-AUDIO
NIBP-OFFSET-DAC
N/C
AC-ON
NIBP-PWM-ADC (analog)
GROUND
GROUND
VIDEO-DATA
KEY-LATCH-N
GROUND
RS232-CTS
NURSE-CALL
REC-CLOCK
REC-LATCH
REC-DATA
REC-STROBE
HRESET
SCI
SPI-DATA-IN
SDC
GROUND
GROUND
P8
J8
+5V
KEY-CLOCK
ON/OFF-KEY
KEY-LATCH-N
+5V
KEY-DATA
GROUND
LED DATA
ACON-LED
GROUND
GROUND
GROUND
LED-LATCH-N
P3
J3
+12V
GROUND
ETCO2-RX(TO J4-17)
ETCO2-TX(TO J4-19)
YEL
ORN
RED
BRN
P6
J6
+12V
VIDEO-VSYNC
VIDEO-HSYNC
GROUND
VIDEO-DATA
GROUND
P1
J1
AC+12V
AC+12V
AC+12V
GROUND
GROUND
GROUND
GROUND
RED
RED
RED
BLK
BLK
BLK
BLK
P5
J5
+12V
Ground
RED
BLK
P11
J11
SP
N/C
SM
RED
BLU
P201
J201
VALVE +
VALVE -
NC
PUMP +
PUMP -
WHT
ORN
RED
BLK
CABLE ASSY
POWER SUPPLY
CABLE ASSY
SPEAKER
CABLE ASSY
PUMP/PNEUTRONICS VALVE
SPEAKER
PUMP
VALVE
RED
BLK
WHT
ORN
MAIN BOARD
SILENCE
BOARD
5 POSITION JUMPER
J3
P3
+5V
SILENCE-LED
SILENCE-SWITCH
GROUND
GROUND

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DRAWING NO.	REV
B 620396	X3
SCALE NONE	SHEET 1 of 1

Drawing Number	Rev.	Sheet No.	Size	Name	Description
620002	C	1of 6	C	Main Board - Model 200	Schematic
620002	C	2 of 6	C	NIBP Electronics	Schematic
620002	C	3 of 6	C	Power Supply DC/DC	Schematic
620002	C	4 of 6	C	Power Isolation and $Sp0_2$ Interface	Schematic
620002	C	5 of 6	C	ECG AMP	Schematic
620002	C	6 of 6	C	ECG A/D Interface	Schematic
620005	C	1 of 6	C	Atlas CPU Sub System	Connector/Header Detail Test Points
620005	C	2 of 6	C	FPGA	U7 Detail
620005	C	3 of 6	C	I/O Filters	Schematic
620005	C	4 of 6	C	Flash, SDRAM 8 HRESET Config Word	Schematic
620005	C	5 of 6	C	Power PC MP C823 CPU	Schematic
620005	C	6 of 6	C	Power Distribution	Schematic
620008	B	1 of 5	C	Front Panel Display Board	Schematic
620008	B	2 of 5	C	Keyboard Scanner	Schematic
620008	B	3 of 5	C	Temp/Pulse LED Drivers	Schematic
620008	B	4 of 5	C	NIBP LED Drivers	Schematic
620008	B	5 of 5	C	$Sp0_2$ LED Drivers	Schematic
620011	C	1 of 1	C	CRT Deflection Board	Schematic
620014	B	1 of 1	C	Printer Electronics	Schematic
620017	D	1 of 8	C	Main Board - Model 220	Schematic
620017	D	2 of 8	C	NIBP Electronics	Schematic
620017	D	3 of 8	C	DC/DC Power Supply	Schematic
620017	D	4 of 8	C	Power Isolation and $Sp0_2$ Interface	Schematic
620017	D	5 of 8	C	ECG AMP	Schematic
620017	D	5 of 8	C	ECG A/D Interface	Schematic
620017	D	7 of 8	C	Respiration	Schematic
620017	D	8 of 8	C	Serial Communication	Schematic
620020	A	1 of 1	C	Transformer Isolator	Component Schematic
620027	B	1 of 1	C	ECG Patient Cable	Component Schematic
620201	A	1 of 1	C	Power Supply Sub Assembly	Exploded View of Sub Assembly
620032	B	1 of 1	B	$ETC0_2$ PCB Assembly	Isometric View of $ETCO_2$ PCB
620150	B	1 of 1	B	Power Supply 50W	Performance Specification
620154/1255210	B	1 of 1	B	Assy, Nonin $Sp0_2$ Board with Shield	Code for Rev Level of Firmware/Software
620152	A	1 of 1	B	Motor Stepper	Motor Schematics and Values
620156	B	1 of 1	B	Pump, Pneumatic	Valves
620165	A	1 of 1	B	Cable Assembly ECG	Cable Pinout
620166	C	1 of 1	B	Cable Assembly CO_2	Cable Pinout
620169	C	1 of 1	B	Cable Assembly Nellcor Sensor	Cable Pinout
620187	B	1 of 1	B	Pneumatic Sub Assembly	Exploded View of Pneumatic Sub
620524	A	1 of 1	B	Cable Assembly CO_2	Cable Pinout

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39118	JAC	3/15/99	LPP
B	See ECN worksheet	5-39456	LPP	4/27/99	LPP
C	Improvements for ESD and Fast Transients	5-39822	LPP	6/23/99	LPP
D	Mods to U2 clock line, NVRAM pullup	5-39934	LPP	7/9/99	

AC/DC Power Connector

J1 CON7: Rec+12V, Rec-GND, AC+12V
R7 150 AC minimum load
J9: Recorder ESD Ground, Tab-.187, Rec-GND

Backup Battery

BackupBattery
J2 CON2, J3 CON2
R22 10K, R23 10K
Q4 2N7002
TP5, TP6
BT1 BR-2/3A 3V Lithium
LithMeas
Page2

Serial Data Out

U2 74HCT595
+5V, C22 .047uF
U2-Reset
SER, SRCLK, SRCLR, RCLK, G, GND, VCC
QA–QH, QH
LED-On
Audio-Shutdown
EROM-wr
TP1 TP2 TP3 TP4

NIBP - Page 2

NIBP-A/D-SelC
NIBP-A/D-SelB
NIBP-A/D-SelA
NIBP-Pump-On
NIBP-ADC-Clock
NIBP-Safety
NIBP-15mmHg
NIBP-Overpressure
NIBP-Valve-Close
NIBP-PWM-ADC
NIBP-Offset-DAC

Fan Connector

+12V, C39 .047uF, J5 CON2

CRT Board Connector

J6 CON6
+12V
Video-VSync
Video-HSync
Video-Data

Main PCA Connector

J4 Socket 30x2

NIBP-Safety	1	2	NIBP-PWM-ADC
+3.3V	3	4	
	5	6	RS232-Tx
	7	8	PIC-Data
NIBP-OP	9	10	RS232-Rx
	11	12	SPO2-Tx
ETCO2-Tx	13	14	SPO2-Rx
ETCO2-Rx	15	16	ADC-Clock
Spare-2	17	18	FE-Clock
NIBP-Data	19	20	SPI-Data-Out
NIBP-15mmHg	21	22	SPI-Clock
LED-Latch	23	24	Batt-ID
Video-HSync	25	26	FE-Data
Spare-3	27	28	Rec-Motor-Step
Power-Sync	29	30	
Vbackup	31	32	
NIBP-Valve-Close	33	34	
Video-VSync	35	36	PIC-Clk
NIBP-Offset-DAC	37	38	Speaker-Audio
	39	40	NIBP2-PW-ADC
ac-on	41	42	
	43	44	Video-Data
Key-Latch-n	45	46	
	47	48	Nurse-Call
Rec-Clock	49	50	Rec-Data-Latch
Rec-Data	51	52	Rec-Strobe
HRESET	53	54	
SPI-data-in	55	56	
	57	58	SCD
	59	60	

PIC-Data, PIC-Clk, Speaker-Audio
HRESET
Jumper wire from J4-20 to J4-55

+3.3V, C3 220pF, C2 .047uF, R20 215
Vbackup, C1 .047uF

U7 AT24C02N-10SC-2.7
SCD, SCL, SDA, A0, A1, A2, WC, GND, VCC
C29 .047uF
U7-wc
R15 1.96K, R16 3.48K, R5 1.21K, R6 1.21K
TP17, TP18

EKG / FE Signals

EKG-PWM-ADC → FE-PWM-ADC
EKG-Data-Clock → FE-Data-Clock
EKG-ADC-Clock → FE-ADC-Clock
FE-Data → FE-Data-In
Power-Sync → FE-Pwr-Sync
U1C 74HCT04, U1D 74HCT04, U1E 74HCT04, U1F 74HCT04, U1B 74HCT04
TP7, TP8, TP9, TP10

SPO2-Rx → SpO2Out
U1A 74HCT04, C23 .047uF

Serial I/O connector

J10 RJ-45
Model 200 Serial I/O (manufacturing test only)
U8 SP232ACN
RS232-RX, Rx, Tx
C30 10uF, C31 0.1uF, C32 0.1uF, C33 0.1uF, C34 0.1uF
TP11 TP12 TP13 TP14 TP15 TP16

Front Panel Display Connector

J8 CON14AP
C5 .047uF, C4 330uF
Key-Clock, Key-Clock-b, Key-Latch-n, Key-Latch-n-b, Key-Data, LED-Data-b, LED-On, LED-Latch-b
U3A 74HCT08, U3B 74HCT08, U3C 74HCT08, U3D 74HCT08
On/Off-Key
Page3

ACON LED

filt+12V, Q1 MMBT3906L, R1 10K, R2 1.96K
Q1-e TP19, Q2-c TP20, Q2-b TP21
Q2 MMBT3904L, R3 10K, R4 10K
ACON
R21 10K, ac-on
Q3 2N7002
Page1

Speaker Drive

TP22, TP23, TP24, TP25
Audio-Shutdown
C35 4.7uF, C36 4.7uF
R17 19.6K, R17-1, U9-4, U9-3
R18 619
C37 0.1uF, R19 19.6K, C38 220pF
U9 TPA301, 4Vpp max.
SP, SM
J11 CON3

Recorder Board Connector

J7 CON24B
PIC-Vprog, Rec-clock, Rec-Data, Rec+12V
Rec-Supply-On, Rec-Motor-Step, Rec-Data-Latch, Rec-Strobe, Rec-Clock, Rec-Data
C7 330uF, C8 .047uF, C14 .047uF, C20 .047uF
Print-Temp, Rec-GND

	Initial	Date
Drawn	Rick Myers	Mar 5, 1999
Designed	Rick Myers	Mar 5, 1999
Checked	L.Phillips	3/16/99
Approved	Z. Psenicnik	3/16/99
Release For Production	J. Bello	3/17/99

Welch Allyn Inc.
Schematic: 620002.dsn
Title: Main Board - Model 200
Size C, Document Number 620002, Rev D
Date: Friday, July 09, 1999, Sheet 1 of 6

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39118	JAC	3/15/99	LPP
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C	Improvements for ESD and Fast Transients	5-39822	LPP	6/23/99	LPP
D	Mods to U2 clock line, NVRAM pullup	5-39934	LPP	7/9/99	

filt+12V
U304
LP2951CD-3.3
C323 4.7uF
C324 4.7uF
R318 10K
TP315
Vb
PIC-Vprog
Rec-Data
Rec-Clock
TP26
TP27
C325 .047uF
U305
D620361-MX10000
PIC-Data
On/Off-Key
PIC-Clk
PIC-audio
R320 1.62K
Speaker-Audio
TP320
R319 19.6K
up-reset
HRESET
TP316
TP317
U2-Reset
TP313
On-Off
Page 1

On/Off Switch

AC+12V
L301 47uH
C301 1000uF
C302 1uF
C303 .01uF
C304 330uF
C305 .01uF
Q301 MTP23P06V
R303 10K
Q301-G
D305 NO LOAD
R301 51.1K
C328-1
R302 100K
C328 1uF
TP301
TP321
Q302 MMBT3904L

R314 100
TP318
D304 MMBD354LT1
d304-1
R316 100
TP319
d304-2
BackupBattery
VBackup
C322 .047uF

+12V
C306 330uF
C307 .047uF

+6V Buck
(5.68V nominal)

Q305 MTP23P06V
Q305-s
L302 47uH
C326 .047uF
Q305-g
R313 10
D303 MBRS340
C314 330uF
C327 .047uF
+6V
C321 .047uF

R304 127K
U301-fb
TP302
R305 100K
R306 10K
TP304
C311-1
C311 2200pF
C313 .047uF
Q304 MMBT3904L
Q304-e
TP303
D301 BAV99L
R312 1.96K
TP305
Q303-c
U301 UC3843A
VFB
COMP
VREF
RT/CT
PWR-GND
GND
ISENSE
Vcc
Vc
OUT
U301-comp
U301-out
U301-osc
TP306
Q306 2N7002
C309 .047uF
R307 7.5K
C310 2200pF
R308 27.4K
TP309
U301-5
TP310
R309 10K
R310 1.96K
TP308
Q303-b
Q303 MMBT3904L
R311 10K
TP307

U302 LM2940CT-5.0
+5V
C316 10uF
C317 .047uF
C315 1uF

U303 LF33CV
+3.3V
C319 100uF
C320 .047uF

TP312
5Vref
ACON

	Initial	Date
Drawn	Rick Myers	Mar 5, 1999
Designed	Rick Myers	Mar 5, 1999
Checked	L.Phillips	3/16/99
Approved	Z. Psenicnik	3/16/99
Release For Production	J. Bello	3/17/99

Welch Allyn Inc.

Schematic: 620002.dsn

Title: Power Supply - DC/DC

Size: C | Document Number: 620002 | Rev: D

Date: Friday, July 09, 1999 | Sheet 3 of 6

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39118	JAC	3/15/99	LPP
B	See ECN worksheet	5-39456	LPP	4/27/99	LPP
C	Improvements for ESD and Fast Transients	5-39822	LPP	6/23/99	LPP
D	Mods to U2 clock line, NVRAM pullup	5-39934	LPP	7/9/99	

Primary Transducer

0mmHG = 0.5V
300mmHG = 4.0V

Zero Adjust

+/-20mmHg range

PWM D/A
76.8KHz

Over Pressure Fault Circuit

Safety Transducer

Zero Offset

A/D Mux

NIBP PWM A/D Converter

	Initial	Date
Drawn	Rick Myers	Mar 5, 1999
Designed	Rick Myers	Mar 5, 1999
Checked	L.Phillips	3/16/99
Approved	Z. Psenicnik	3/16/99
Release For Production	J. Bello	3/17/99

Welch Allyn Inc.

Schematic: 620002.dsn

Title: NIBP Electronics

Size C | Document Number 620002 | Rev D

Date: Friday, July 09, 1999 Sheet 2 of 6

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39118	JAC	3/15/99	LPP
B	See ECN worksheet	5-39456	LPP	4/27/99	LPP
C	Improvements for ESD and Fast Transients	5-39822	LPP	6/23/99	LPP
D	Mods to U2 clock line, NVRAM pullup	5-39934	LPP	7/9/99	

Isolation Barrier

Isolated SpO2 Circuits

Grounded SpO2 Circuits

iso+5Vdig
C403 .047uF
C406 100uF
C415 1uF
U403 LP2951C
VOUT
ERR
VIN
FDBK
SHTDN
TAP
SENS
GND
U403-7
TP401
C401 .047uF

fVcc
C402 .047uF
C405 100uF
D401 MBRS130T3
T401-1
R419 215
TP403
C421-1
C421 470pf
T401
T401-8
fVee
C404 .047uF
C407 100uF
D403 MBRS130T3
T401-4
IsoXfmr

filt+12V
C412 10uF
C409 470pf
C409-1
TP402
R405 215
+12V
C414 .047uF
TP406
TP408
D405 BAV99L
TP409
Q401 MTD3055V
Q401-g
R407 10
Q402-e
Q402 MMBT3906L
U402-e
R409 5.11K
R406 0.2
TP417
TP414
TP415
R408 100
TP416
Q401-s
C410 .01uF
U402-sen
U402 LM3524DM
VIN
VREF
SHTDWN
OSCOUT
RT
CT
+SENSE
-SENSE
GND
V+
V-
COMP
U402-ref
TP404
C420 .047uF
U402-rt
U402-ct
FE-Pwr-Sync
TP412
TP413
C411 2200pF
R410 10K

TP407
f+5V
R415 100
C416 .047uF
U401-7
U401B MC34072
fVcc
TP405
R416 10K
U401-5
iso+5Vdig
C418 4.7uF
TP411
C417 680pf

J403
SpO2 ESD Ground
Tab-.187

J401
sSpO2tx
fVcc
C419 10uF
CON4

R417 10K
TP419
fVcc
U401-3
U401-2
U401A MC34072
TP420
R403 1K
U401-1
iso401-a
U410 4N25
R418 5.11K

+5V
R411 5.11K
iso401-b
opto-fb
R404 316K

iso+5Vdig
R401 10K
TP421
C408 .01uf
TP422
R402 10K
C408-2
R420 9.09K

iso+5Vdig
C413 .047uF
sSpO2tx
Q403 MMBT3904L
TP423
Q403-e
R412 511
iso402-a
U411 HCNW4503

+5V
R414 6.19K
R421 10K
TP424
SpO2Out
u411-6
C422 .047uF
C423 1000pF

	Initial	Date
Drawn	Rick Myers	Mar 5, 1999
Designed	Rick Myers	Mar 5, 1999
Checked	L.Phillips	3/16/99
Approved	Z. Psenicnik	3/16/99
Release For Production	J. Bello	3/17/99

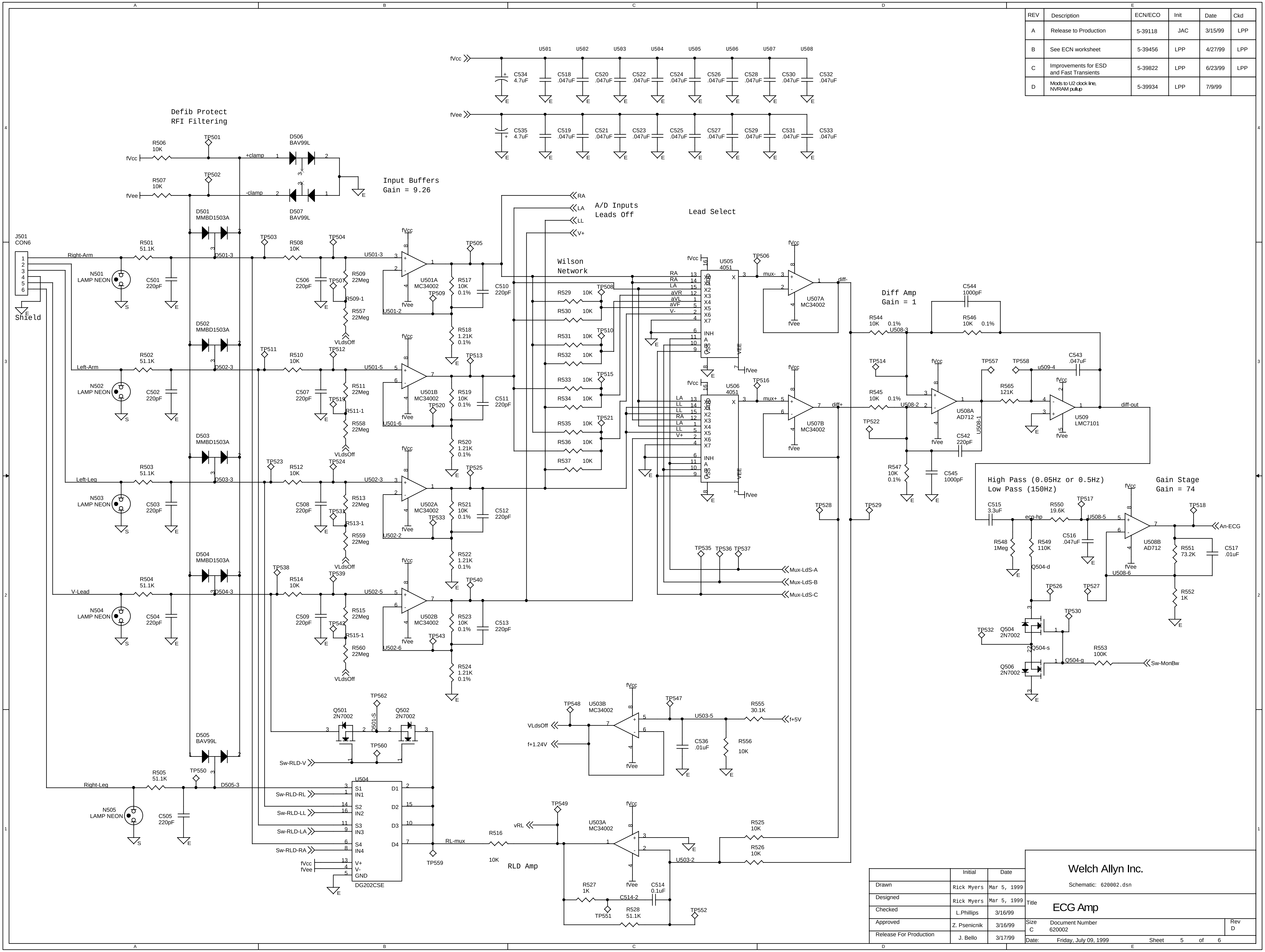
Welch Allyn Inc.

Schematic: 620002.dsn

Title: Power Iso and SpO2 interface

Size C | Document Number 620002 | Rev D

Date: Friday, July 09, 1999 | Sheet 4 of 6



REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39118	JAC	3/15/99	LPP
B	See ECN worksheet	5-39456	LPP	4/27/99	LPP
C	Improvements for ESD and Fast Transients	5-39822	LPP	6/23/99	LPP
D	Mods to U2 clock line, NVRAM pullup	5-39934	LPP	7/9/99	

	Initial	Date
Drawn	Rick Myers	Mar 5, 1999
Designed	Rick Myers	Mar 5, 1999
Checked	L.Phillips	3/16/99
Approved	Z. Psencinik	3/16/99
Release For Production	J. Bello	3/17/99

Welch Allyn Inc.

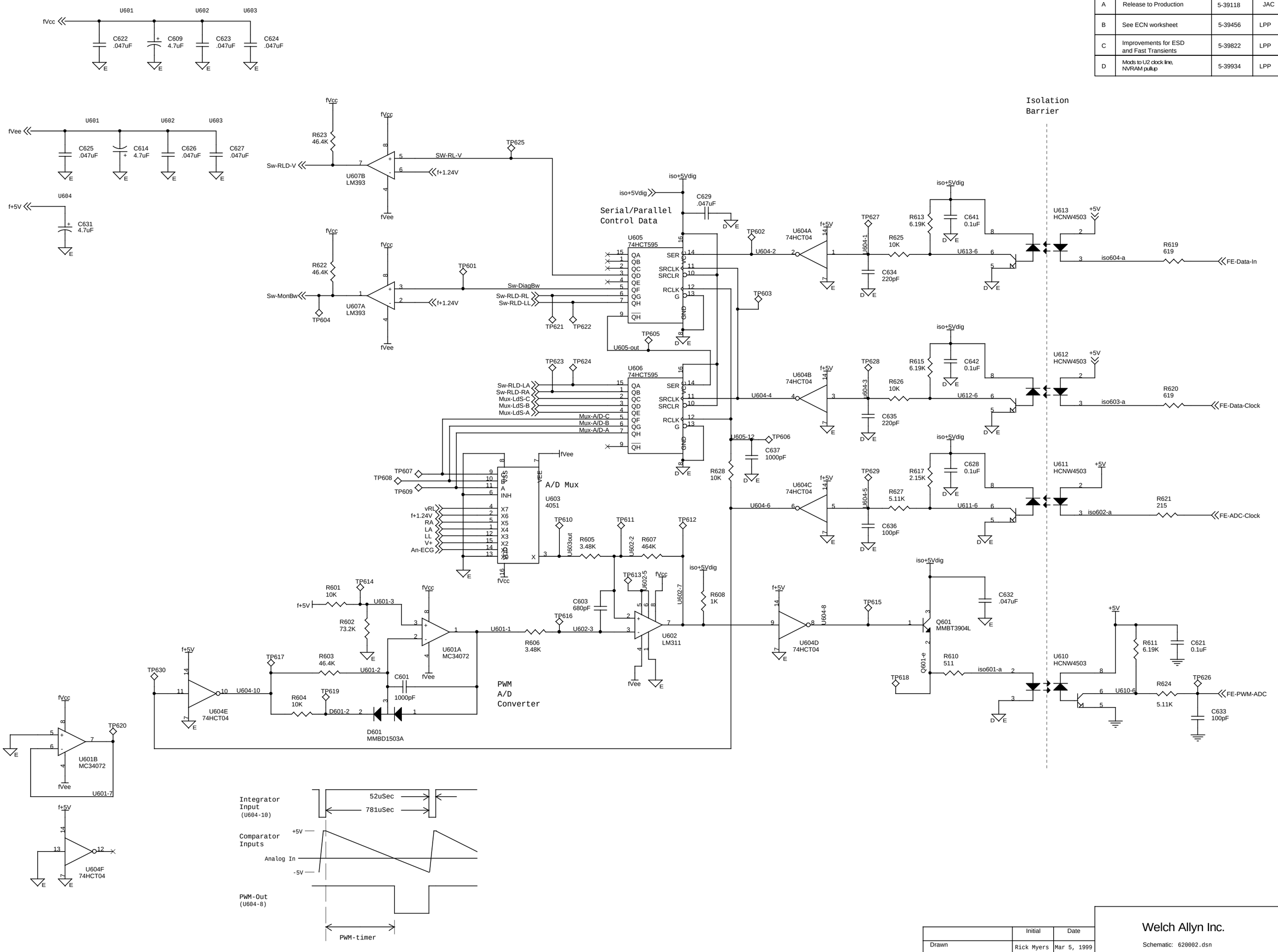
Schematic: 620002.dsn

Title: ECG Amp

Size: C — Document Number: 620002 — Rev: D

Date: Friday, July 09, 1999 — Sheet 5 of 6

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39118	JAC	3/15/99	LPP
B	See ECN worksheet	5-39456	LPP	4/27/99	LPP
C	Improvements for ESD and Fast Transients	5-39822	LPP	6/23/99	LPP
D	Mods to U2 clock line, NVRAM pullup	5-39934	LPP	7/9/99	



	Initial	Date
Drawn	Rick Myers	Mar 5, 1999
Designed	Rick Myers	Mar 5, 1999
Checked	L.Phillips	3/16/99
Approved	Z. Psenicnik	3/16/99
Release For Production	J. Bello	3/17/99

Welch Allyn Inc.

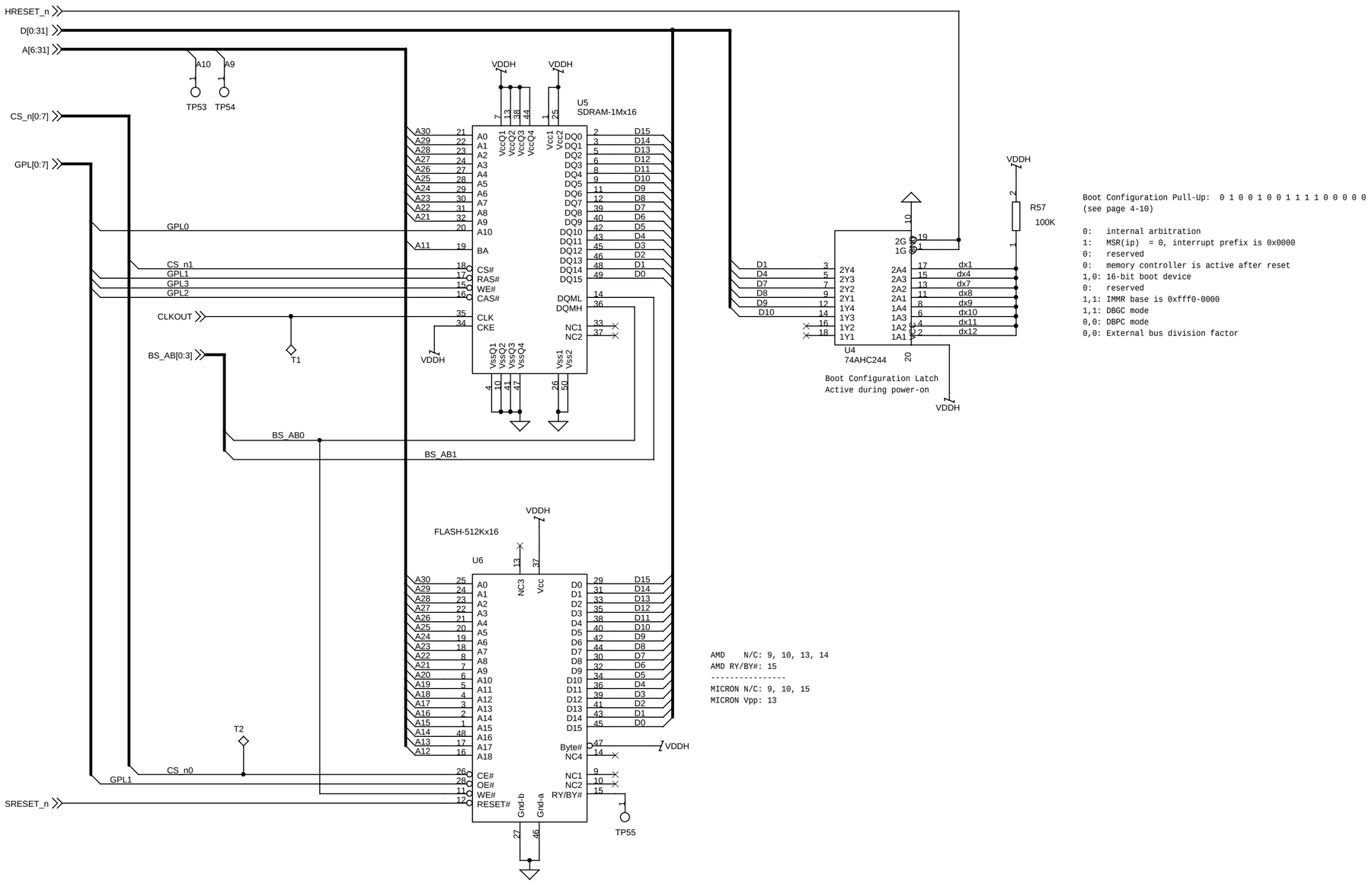
Schematic: 620002.dsn

Title: ECG A/D and Interface

Size: C | Document Number: 620002 | Rev: D

Date: Friday, July 09, 1999 | Sheet 6 of 6

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39173	JAC	3/18/99	LPP
B	**Component change for frequency modulation**	**5-39353**	**JJC**	**4/15/99**	**ZIP**
C	**Change Reset IC U3, No Load C40**	5-39830	LPP	6/24/99	



	Initial	Date
Drawn	Jim Belesiu	Mar 5, 1999
Designed	Jim Belesiu	Mar 5, 1999
Checked	L. Phillips	3/19/99
Approved	Z. Psenicnik	3/19/99
Release For Production	J. Bello	3/19/99

Welch Allyn Inc.

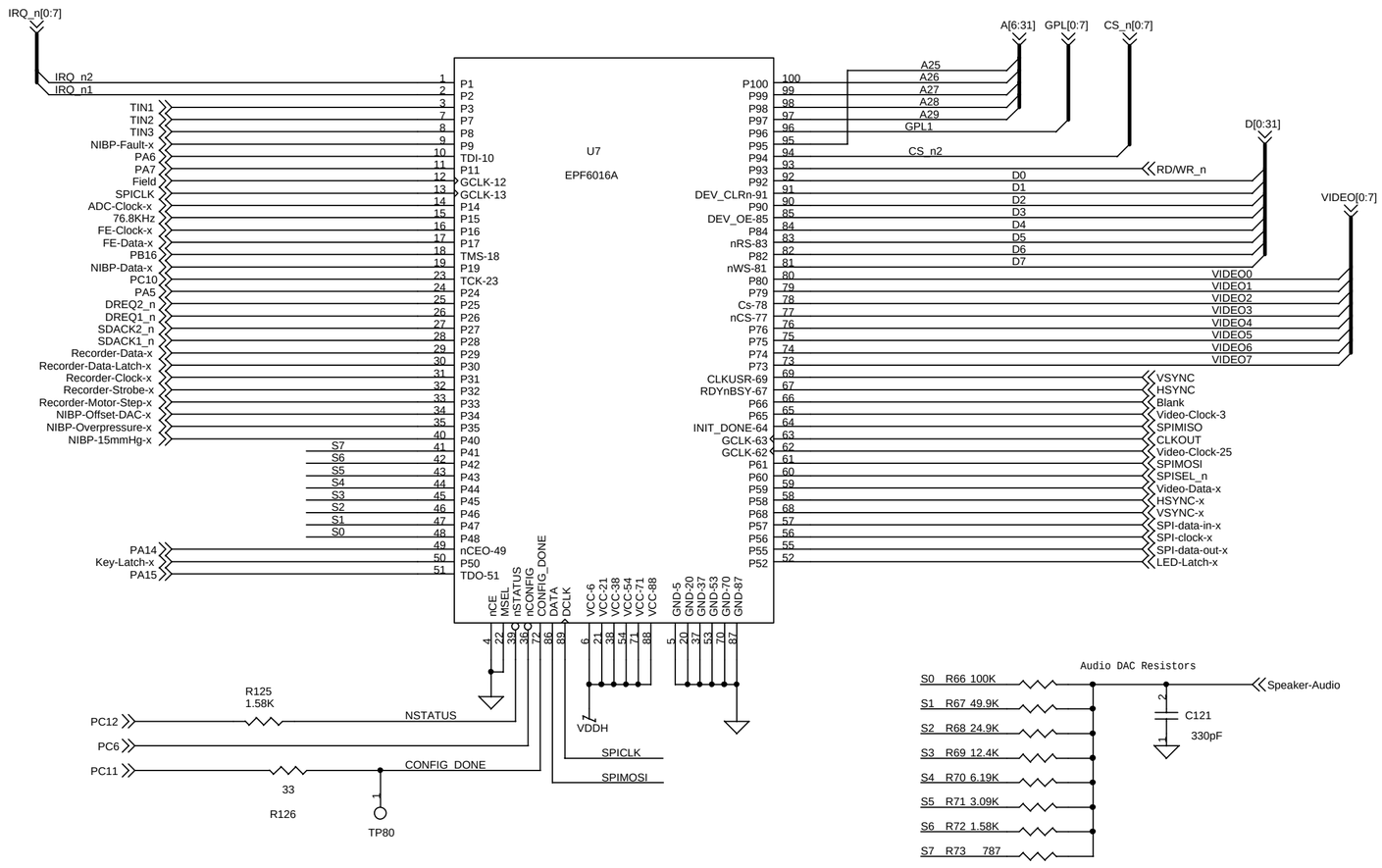
Schematic: 620005.dsn

Title: Flash, SDRAM and HRESET Config Word

Size: C | Document Number: 620005 | Rev: C

Date: Thursday, June 24, 1999 | Sheet 4 of 6

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39173	JAC	3/18/99	LPP
B	**Component change for frequency modulation**	**5-39353**	**JJC**	**4/15/99**	**ZIP**
C	**Change Reset IC U3, No Load C40**	5-39830	LPP	6/24/99	



	Initial	Date
Drawn	Jim Belesiu	Mar 5, 1999
Designed	Jim Belesiu	Mar 5, 1999
Checked	L. Phillips	3/19/99
Approved	Z. Psenicnik	3/19/99
Release For Production	J. Bello	3/19/99

Welch Allyn Inc.

Schematic: 620005.dsn

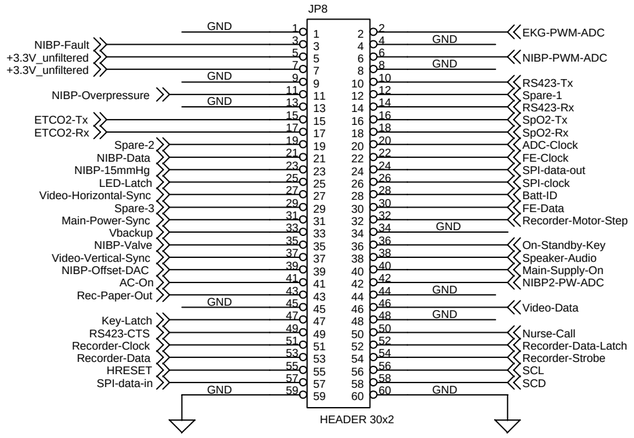
Title: FPGA

Size: C | Document Number: 620005 | Rev: C

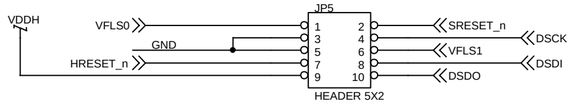
Date: Thursday, June 24, 1999 | Sheet 2 of 6

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39173	JAC	3/18/99	LPP
B	**Component change for frequency modulation**	**5-39353**	**JJC**	**4/15/99**	**ZIP**
C	**Change Reset IC U3, No Load C40**	5-39830	LPP	6/24/99	

Main PCA Connectors

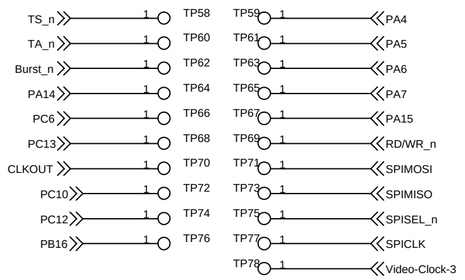


CPU PCA SW Debug Port (aka BDM Connector)



1 - Visual History Buffer Flush Status (’823 output)
2 - Reset Output (’823 input)
3 - Ground
4 - BDM Clock (’823 input)
5 - Ground
6 - Visual History Buffer Flush Status (’823 output)
7 - Reset Input (’823 Output)
8 - BDM Data Input (’823 Input)
9 - Vcc
10 - BDM Data Output (’823 Output)

Test Points



	Initial	Date
Drawn	Jim Belesiu	Mar 5, 1999
Designed	Jim Belesiu	Mar 5, 1999
Checked	L. Phillips	3/19/99
Approved	Z. Psenicnik	3/19/99
Release For Production	J. Bello	3/19/99

Welch Allyn Inc.

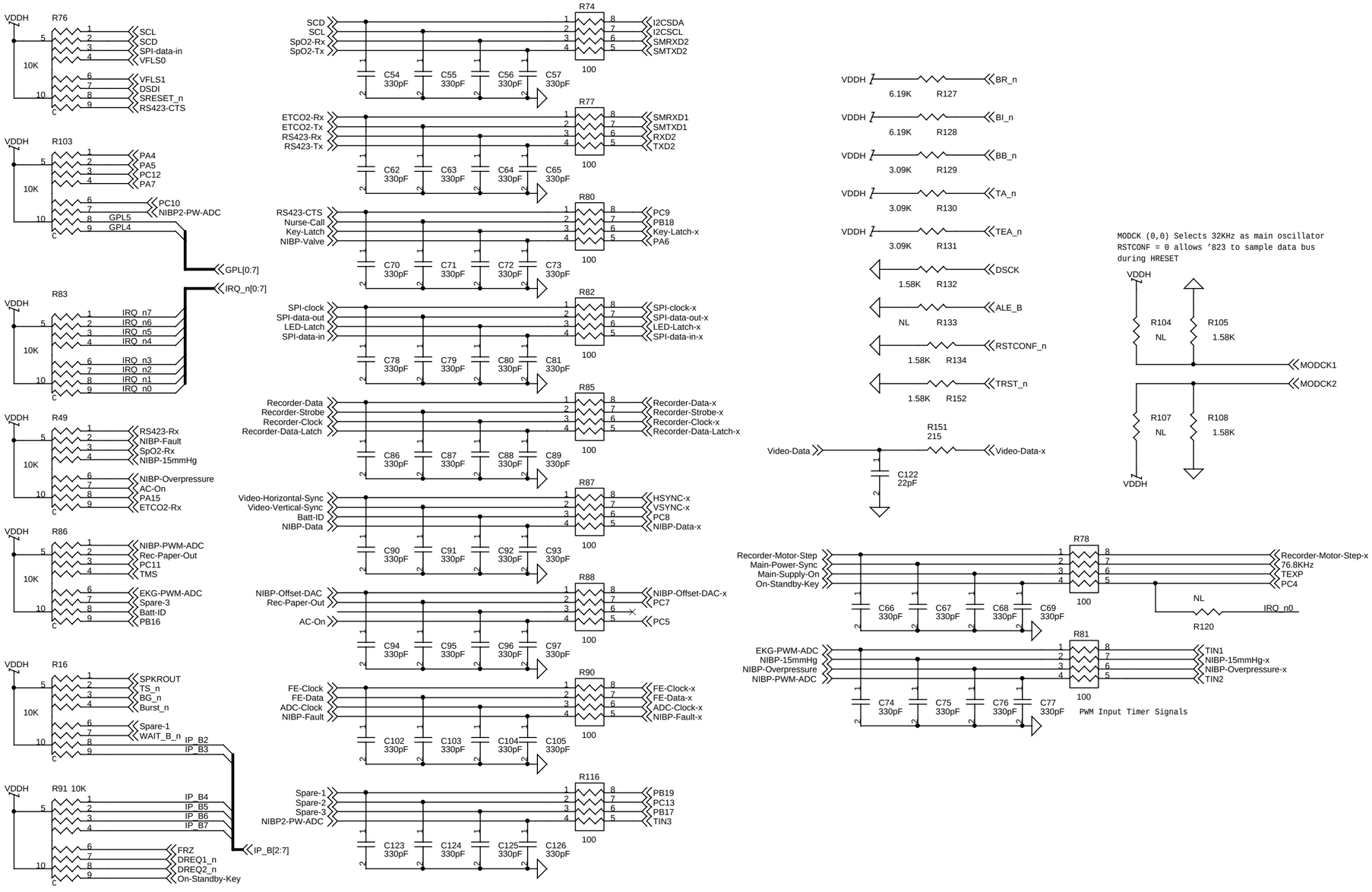
Schematic: 620005.dsn

Title: Atlas CPU Subsystem

Size C | Document Number 620005 | Rev C

Date: Thursday, June 24, 1999 Sheet 1 of 6

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39173	JAC	3/18/99	LPP
B	**Component change for frequency modulation**	**5-39353**	**JJC**	**4/15/99**	**ZIP**
C	**Change Reset IC U3, No Load C40**	5-39830	LPP	6/24/99	



	Initial	Date
Drawn	Jim Belesiu	Mar 5, 1999
Designed	Jim Belesiu	Mar 5, 1999
Checked	L. Phillips	3/19/99
Approved	Z. Psenicnik	3/19/99
Release For Production	J. Bello	3/19/99

Welch Allyn Inc.

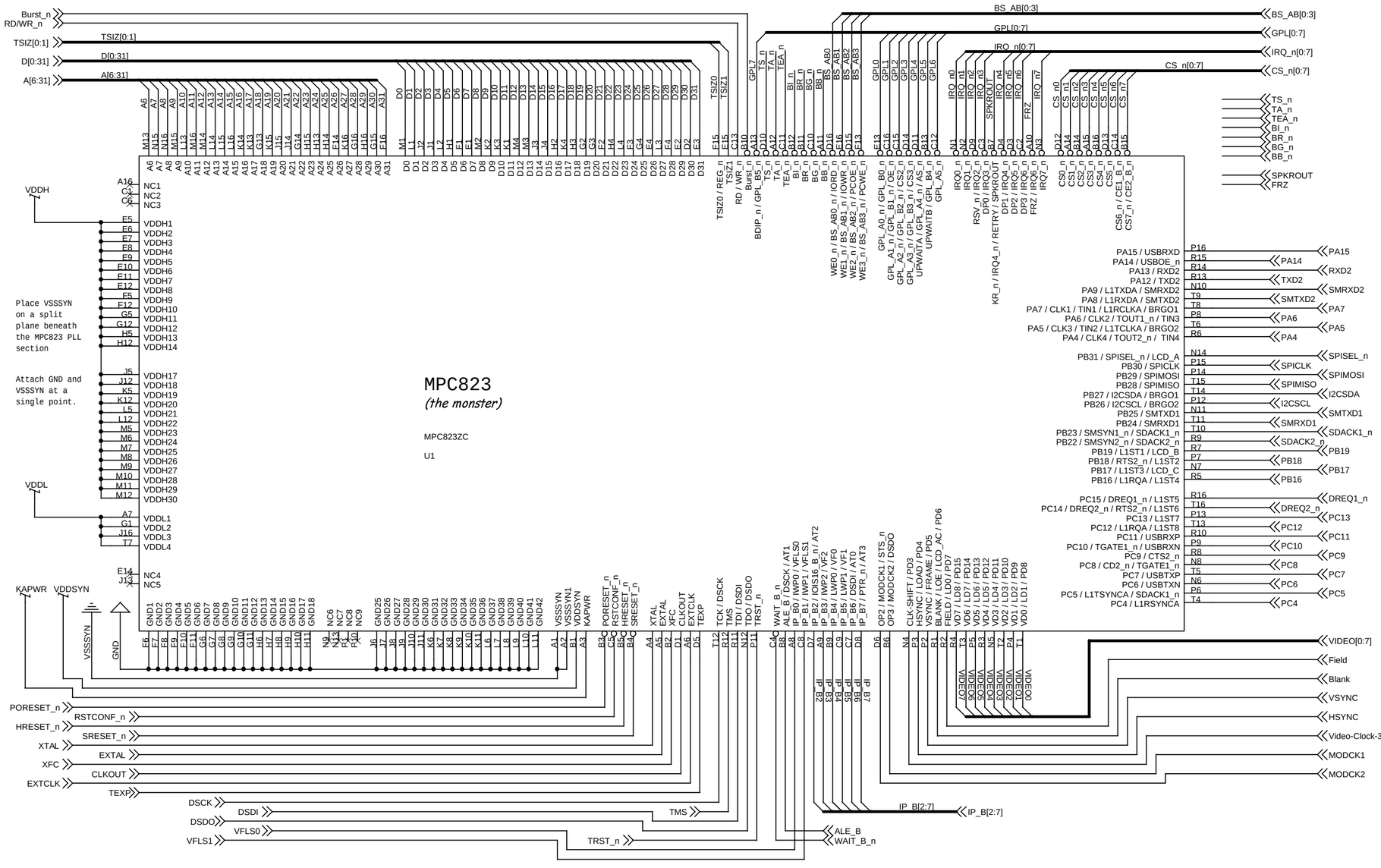
Schematic: 620005.dsn

Title: I/O Filters

Size C | Document Number 620005 | Rev C

Date: Thursday, June 24, 1999 Sheet 3 of 6

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39173	JAC	3/18/99	LPP
B	**Component change for frequency modulation**	**5-39353**	**JJC**	**4/15/99**	**ZIP**
C	**Change Reset IC U3, No Load C40**	5-39830	LPP	6/24/99	



	Initial	Date
Drawn	Jim Belesiu	Mar 5, 1999
Designed	Jim Belesiu	Mar 5, 1999
Checked	L. Phillips	3/19/99
Approved	Z. Psenicnik	3/19/99
Release For Production	J. Bello	3/19/99

Welch Allyn Inc.

Schematic: 620005.dsn

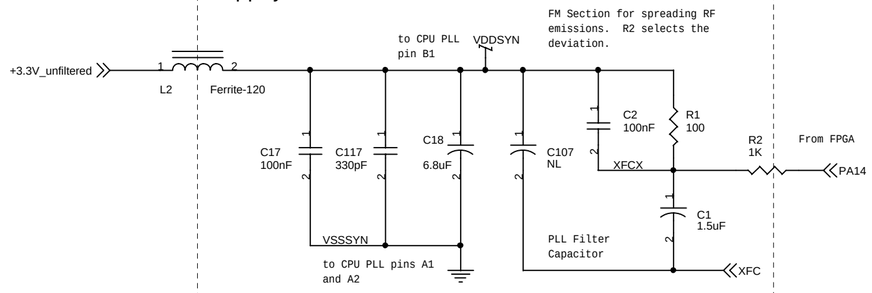
Title: PowerPC MPC823 CPU

Size: C | Document Number: 620005 | Rev: C

Date: Thursday, June 24, 1999 | Sheet 5 of 6

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39173	JAC	3/18/99	LPP
B	**Component change for frequency modulation**	**5-39353**	**JJC**	**4/15/99**	**ZIP**
C	**Change Reset IC U3, No Load C40**	5-39830	LPP	6/24/99	

MPC823 PLL Supply



Place decoupling capacitors next to CPU VDDSYN pin B1 and VSSSYN pin A1 and A2

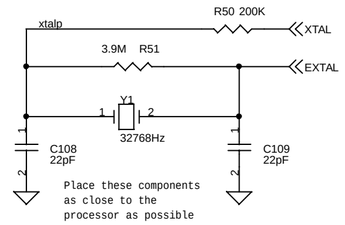
Use separate PPL VDDSYN power plane from 3.3V plain

Split ground plane under these components

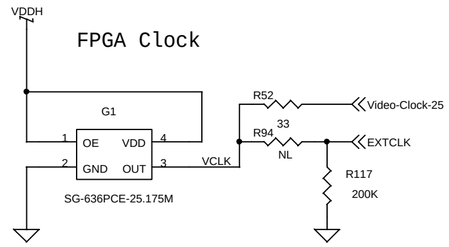
1536*830 < XFC < 1536*1470 pf Value selected for the final mulitplication ratio

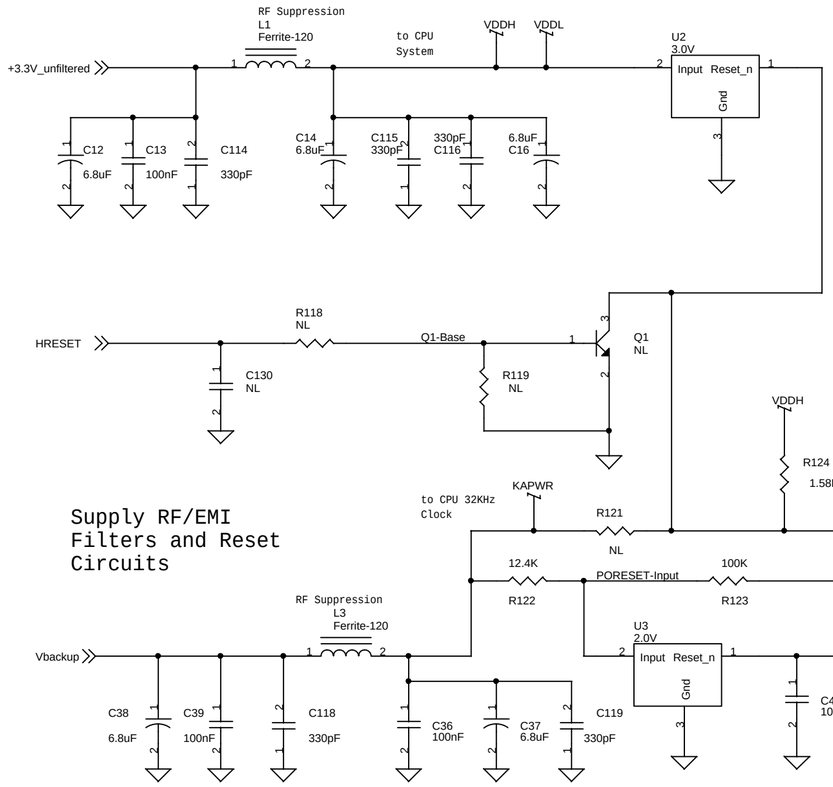
Load C107 w/1.5uF and unload C1 for non-FM clocking

System Clock

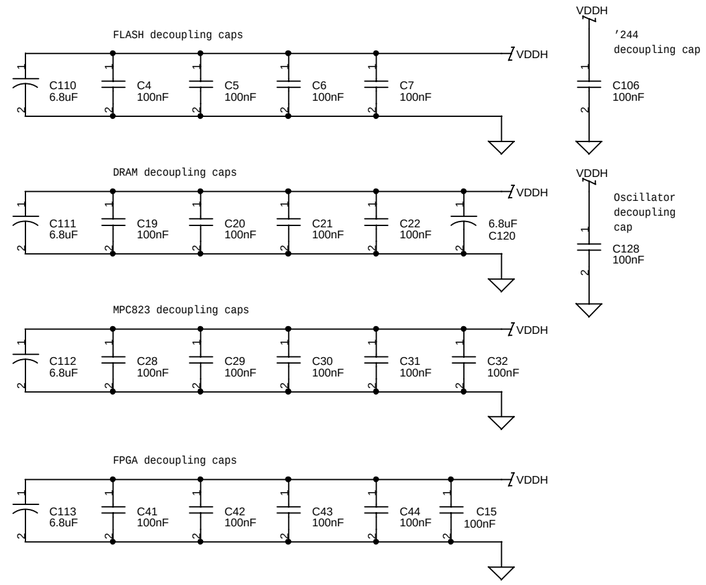


FPGA Clock





Supply RF/EMI Filters and Reset Circuits



	Initial	Date
Drawn	Jim Belesiu	Mar 5, 1999
Designed	Jim Belesiu	Mar 5, 1999
Checked	L. Phillips	3/19/99
Approved	Z. Psenicnik	3/19/99
Release For Production	J. Bello	3/19/99

Welch Allyn Inc.

Schematic: 620005.dsn

Title: Power Distribution, Clocks and Reset

Size C | Document Number 620005 | Rev C

Date: Thursday, June 24, 1999 | Sheet 6 of 6

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39251	JAC	3/23/99	LPP
B	No Load D16	5-39485	LPP	4/28/99	LPP
C	D13 to Low Profile, R51 to 316	5-39994	LPP	7/23/99	

Break-Away PCB Section
Flag Pole Area

Trend
SW9
Trend-sw
Lead Select
SW11
Lead-Select-sw
Print
SW13
Print-sw
R65 1.21K
R66 1.21K
R67 1.21K
R68 1.21K
ACLED-1
ACLED-2
5x5 Green
D1
D2
5x5 Green
AC On LEDs
AC-On-x
FP-Common
J2xA
flex-cable-5

ACON-LED
On/Off-sw
Clock1
Key-data-b
Keyboard Circuits
On/Off-sw
Key-Clock-b
Key-Latch-b
Key-Data-b
Trend
Lead-Select
Print
Silence-Switch
Front Panel - A
Trend
Lead-Select
Print
J2A
flex-cable-5

Place capacitors
by connector
VCC
C9
4.7uF
C27
4.7uF
J1
Key-Clock
Key-Latch-n
Key-Data
LED-Data
LED-Enable
LED-Latch-n
HEADER 7X2
U26
74HC244
u26-18
Key-Latch-b
LED-Data-b
u26-9
u26-7
LED-Latch-1
LED-Latch-2
TP182
R71
100
R51
316
On-Led
D13
T1 (3mm) Green
On/Standby
R1
2.2K

I705144
LED_TP_Enable
LED_TP_Data_In
LED_TP_Clock
LED_TP_Latch
LED_TP_Data_Out
Front Panel - B
TP183
R72
100
Clock2
u19-out

R2
2.15K
U1A
U1B
U1C
U1D
U1E
U1F
74HC04
LED_TP_enable
LED_NIBP_enable
LED_SPO2_enable
TP2
TP3
TP4

NIBP LED Circuits
LED_NIBP_Enable
LED_NIBP_Data_In
LED_NIBP_Clock
LED_NIBP_Latch
LED_NIBP_Data_Out
Silence-LED
Front Panel - C
TP184
R73
100
Clock3
u13-out

I705124
LED_SpO2_Enable
LED_SpO2_Data_In
LED_SpO2_Clock
LED_SpO2_Latch
Front Panel - D

Silence Button
Break-Away PCB
Section
D10-Vcc
D10-C
D10
T1 (3mm) Red
Silence LED
Silence-LED
Silence-Switch
J3A
J3xA
flex-cable-5
Sil-Sw-a
Sil-Sw-b
SW22
Silence
Switch
SW28

Place one tantalum
cap near each seven
segment LED group
C1
C8
C10
C11
C28
4.7uF

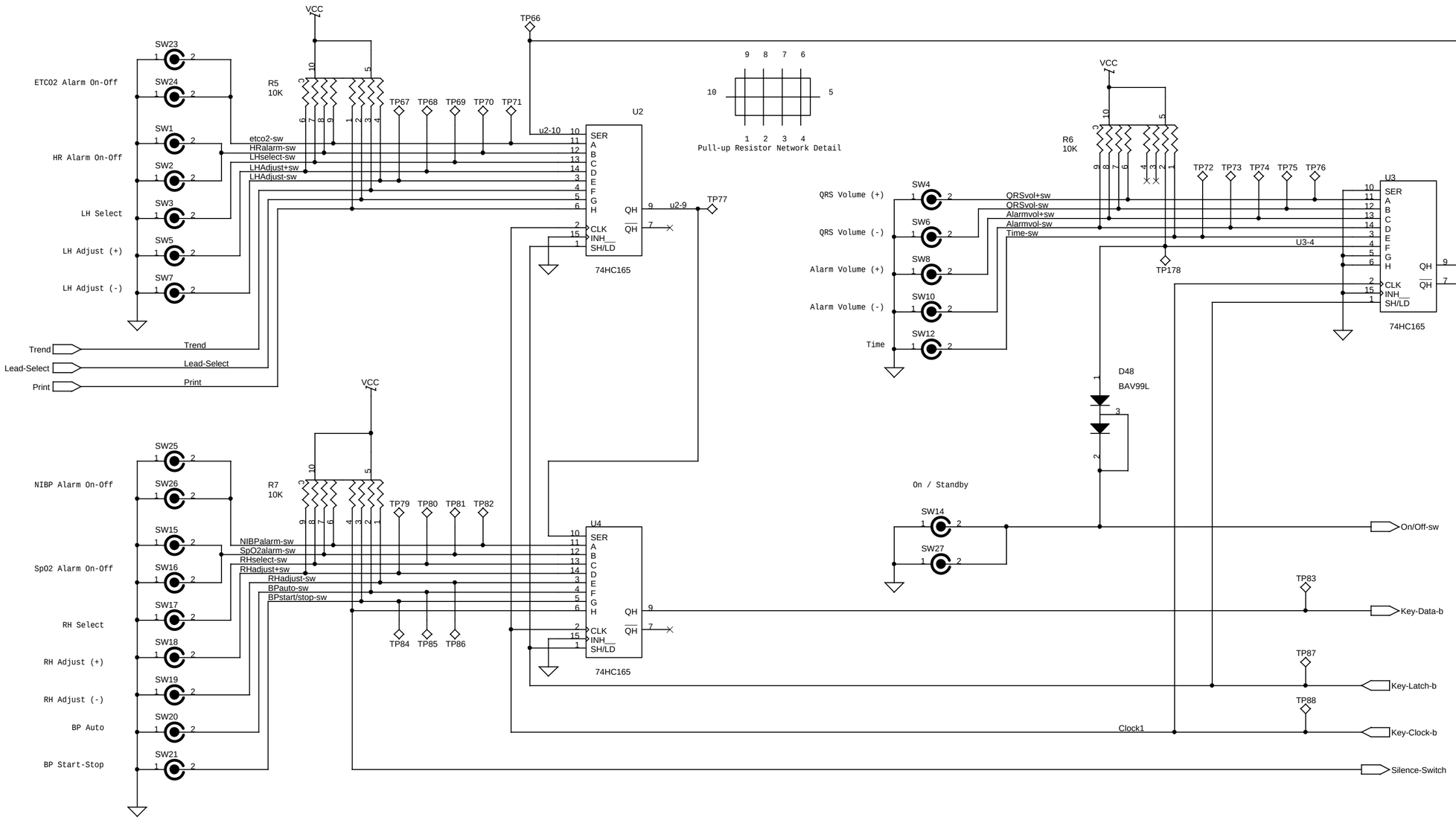
Place one
ceramic cap
near each
IC
C2
C3
C4
C5
C6
C7
C12
C13
C14
C15
C16
C17
C18
C19
C20
C21
C22
C23
C24
C25
C26
0.1uF

9 8 7 6
10 5
1 2 3 4
Pull-up Resistor Network Detail

	Initial	Date
Drawn	Jim Belesiu	3/15/99
Designed	Jim Belesiu	3/15/99
Checked	L. Phillips	3/24/99
Approved	Z. Psenicnik	3/24/99
Release For Production	J. Bello	3/24/99

Welch Allyn Inc.
Schematic:
Title: Front Panel Display Board
Size C
Document Number 620008
Rev C
Date: Friday, July 23, 1999
Sheet 1 of 5

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39251	JAC	3/23/99	LPP
B	No Load D16	5-39485	LPP	4/28/99	LPP
C	D13 to Low Profile, R51 to 316	5-39994	LPP	7/23/99	



	Initial	Date
Drawn	Jim Belesiu	3/15/99
Designed	Jim Belesiu	3/15/99
Checked	L. Phillips	3/23/99
Approved	Z. Psenicnik	3/23/99
Release For Production	J. Bello	3/23/99

Welch Allyn Inc.

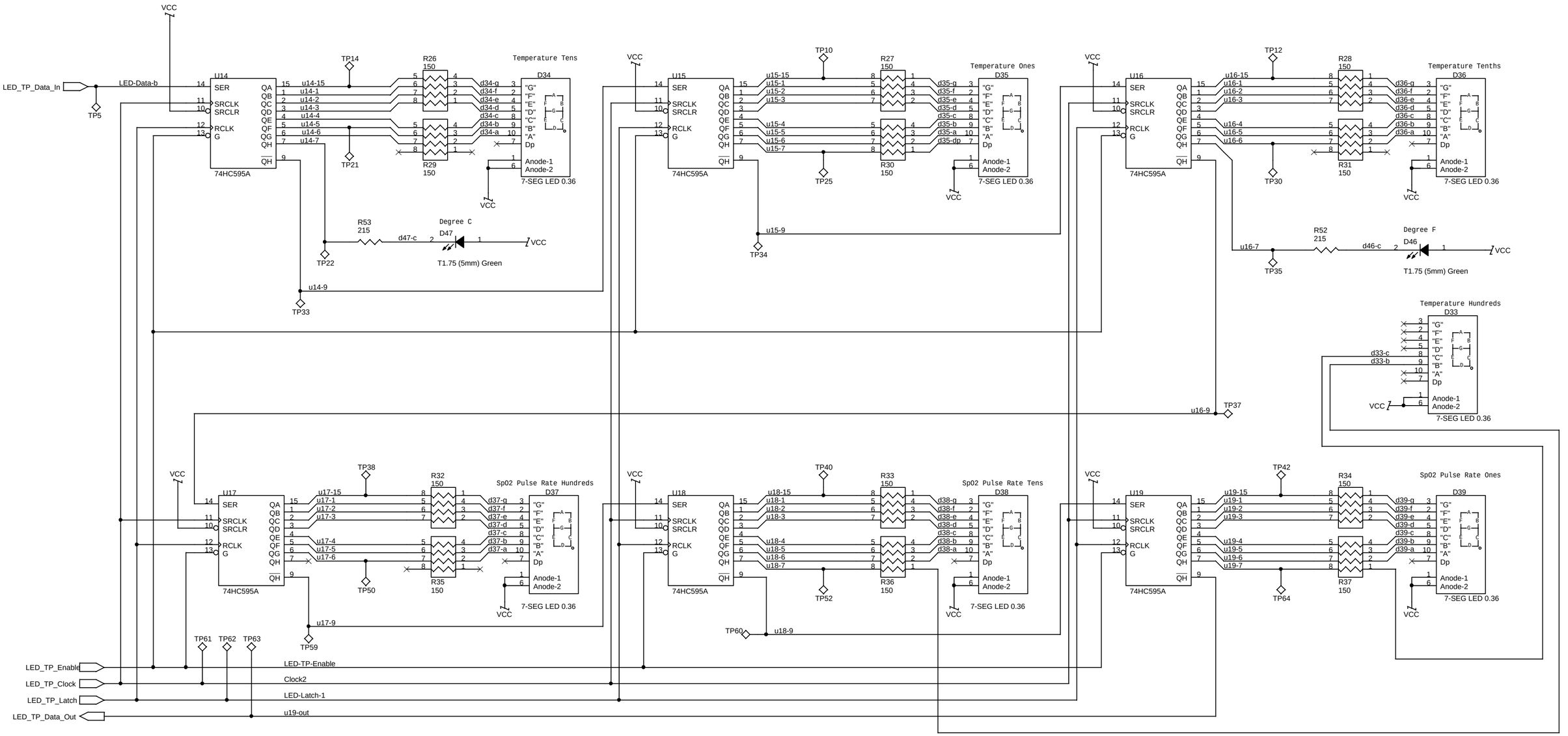
Schematic: 620008.dsn

Title: Keyboard Display Board

Size: C | Document Number: 620008 | Rev: C

Date: Friday, July 23, 1999 | Sheet 2 of 5

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39251	JAC	3/23/99	LPP
B	No Load D16	5-39485	LPP	4/28/99	LPP
C	D13 to Low Profile, R51 to 316	5-39994	LPP	7/23/99	



	Initial	Date
Drawn	Jim Belesiu	3/15/99
Designed	Jim Belesiu	3/15/99
Checked	L. Phillips	3/24/99
Approved	Z. Psenicnik	3/24/99
Release For Production	J. Bello	3/24/99

Welch Allyn Inc.

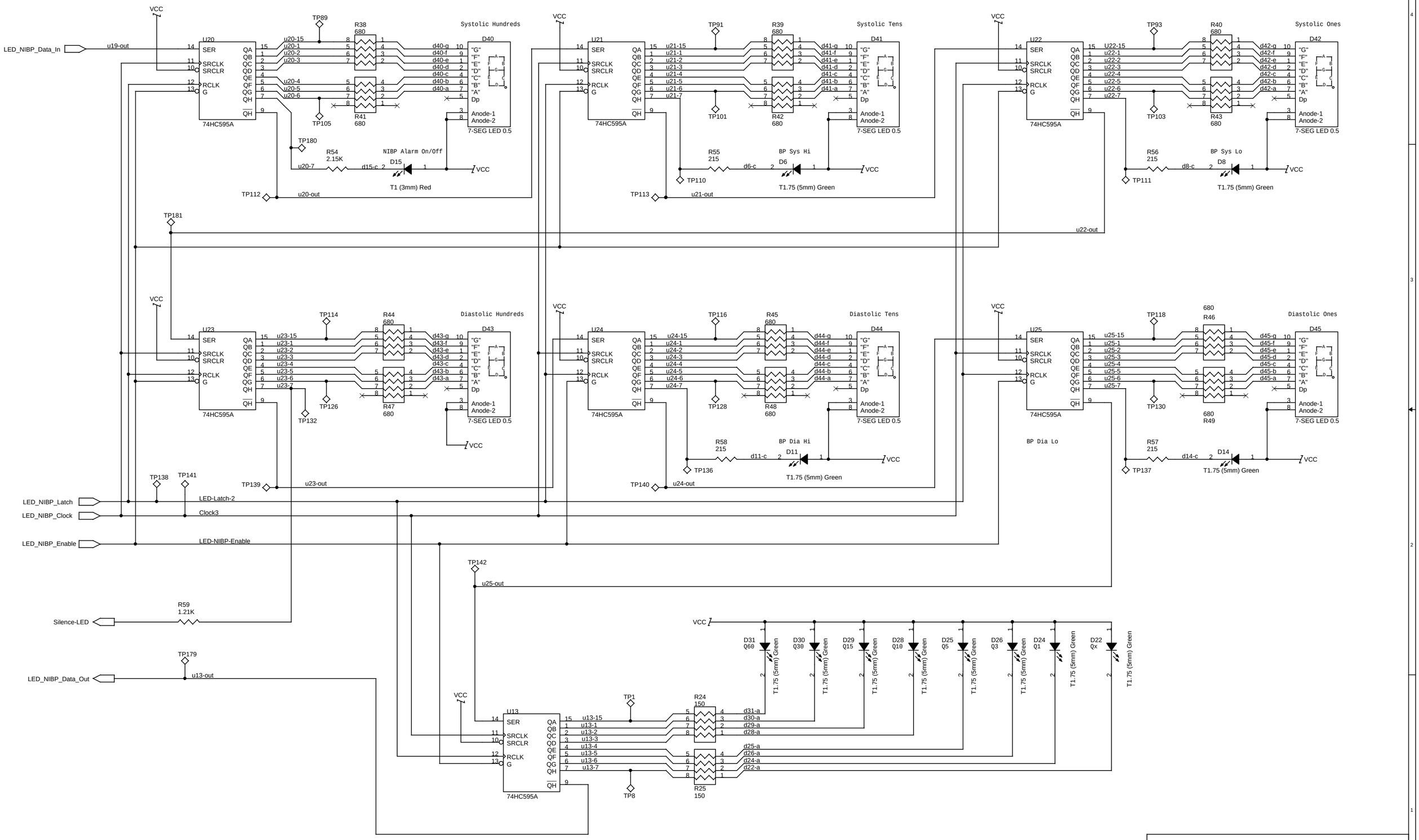
Schematic: 620008.dsn

Title: Temp/Pulse LED Drivers

Size C | Document Number 620008 | Rev C

Date: Friday, July 23, 1999 | Sheet 3 of 5

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5.-39251	JAC	3/23/99	LPP
B	No Load D16	5-39485	LPP	4/28/99	LPP
C	D13 to Low Profile, R51 to 316	5-39994	LPP	7/23/99	



	Initial	Date
Drawn	Jim Belesiu	3/15/99
Designed	Jim Belesiu	3/15/99
Checked	L. Phillips	3/24/99
Approved	Z. Psenicnik	3/24/99
Release For Production	J. Bello	3/24/99

Welch Allyn Inc.

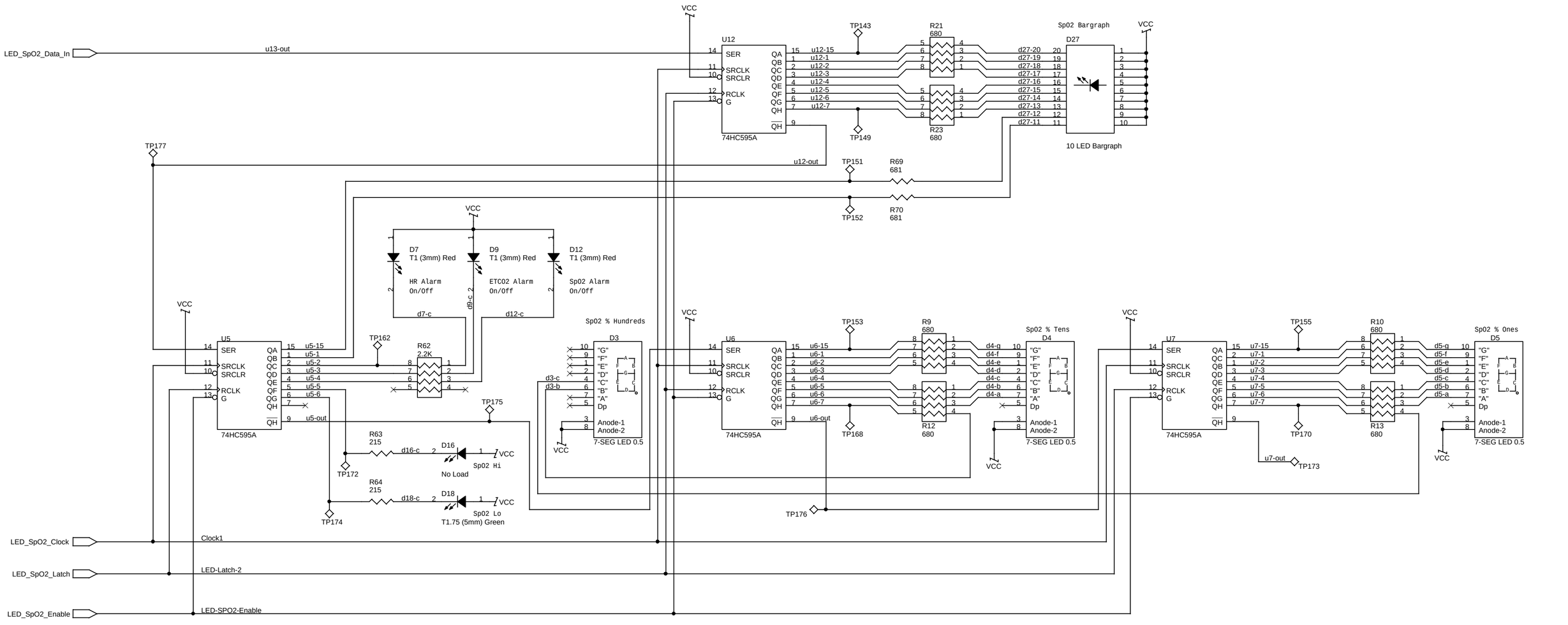
Schematic: 620008.dsn

Title: NIBP LED Drivers

Size: C | Document Number: 620008 | Rev: C

Date: Friday, July 23, 1999 | Sheet 4 of 5

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39251	JAC	3/23/99	LPP
B	No Load D16	5-39485	LPP	4/28/99	LPP
C	D13 to Low Profile, R51 to 316	5-39994	LPP	7/23/99	



	Initial	Date
Drawn	Jim Belesiu	3/15/99
Designed	Jim Belesiu	3/15/99
Checked	L. Phillips	3/24/99
Approved	Z. Psenicnik	3/24/99
Release For Production	J. Bello	3/24/99

Welch Allyn Inc.

Schematic: 620008.dsn

Title: SPO2 LED Drivers

Size: C | Document Number: 620008 | Rev: C

Date: Friday, July 23, 1999 | Sheet 5 of 5

Width Coil (L3)
inductance range
changed

Vertical Amplifier

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39097	JAC	3/9/99	LPP
B	Modify Video Amplifier Reduce RF Emissions	**5-39339**	**JJC**	**4/15/99**	**ZIP**
C	Increase Flex Cable to 3 inches	5-39831	LPP	6/24/99	LPP
D	Width Coil Inductance (L3) increased	5-40006	LPP	7/23/99	

Vertical Sync
750uSec
16.7mSec
R1 1K
R2 7.50K
U1.3
+5V
Ramp Generator
+12V
C3 .047uF
C4 .047uF
U4A
74HCT04
R3 23.7K
U4.2
R52 1.96K
R43 5.11K
U1A TLC272
ramp
C1 .1uF
U1.2
d6.c
D6 1N4148
D1 1N4148
U2A MC34072
C2 100pf
u2.1
u2.2
R4 10K
R5 42.2K
R6 41.2K
u1.6
u1.7
U1B TLC272
u1.5
R7 41.2K
R8 41.2K
Zero Adjust
vcadj
R9 1.47K
vcadj+
R10 1K
vcadj-
R11 1.96K
R12 562
R13 169
R14 562
q1.b2
q2.b2
Q1 MPSW01A
Q2 MPSW51A
q1.e
R15 38.3
R16 10
vadj
R17 10
Size Adjust
R18 562
Q3 MPSW01A
Q4 MPSW51A
R19 562
R20 169
R21 562
q3.b
q4.b
U2B MC34072
R22 10K
R23 10K
u2.7
u2.6
To Yoke
J2
vert-
vert+
j2-3
hor+
hor-
CON5
R31 10K
To Main Board
J1
Vsync
Hsync
Video
CON6
U3 MC78L05ACP
VIN
VOUT
GND
C6 .047uF
C7 .047uF
Horizontal Sync
5.5uSec
31.7uSec
R50 1.96K
U4B
74HCT04
C22 .022uF
u4.4
C22-2
R24 10K
R25 215
q5.b
R26 1K
R27 10
q5.c
q6.d
Q5 2N3904
Q6 IRF640
C8 .022uF
C9 6.8uF
hlin
L2 15uH
hwide
L3 15- 35uH
T1 CRT-FBT
To CRT Anode
Boost
C11 1000uF
D2 MUR120
L1 47uH
+12filt
C10 1000uF
+B
Hor
Vd
Vg1
Vg2
D3 1N4935
D4 1N4935
D5 1N4937
+Vvid
C12 22uF
C13 22uF
C14 .01uF
d4.a
d5.c
Horizontal Amplifier
Grid Voltages
Grid1
Grid2
C15 .01uF
C16 .01uF
C17 .01uF
R29 100K
R28 19.6K
Brightness Adjust
R30 100K
R32 2.5Meg
Focus
Focus Adjust
Video Amplifier
+Vvid
C19 .01uF
R36 1.96K
R37 1.96K
C18 .047uF
R51 19.6K
U4E
74HCT04
R48 100
u4-6
q7-g
Q7 BS170
q8-b
Q8 2N3904
D7 1N4148
q8-e
R41 681
vidout
C20 No Load
6 Position flat ribbon cable
Connects Main CRT to CRT
socket Board
Break Away CRT socket Board
1/2W Carbon Comp
J3
J3x
Flex6
J3.1
J3.3
J3.5
J3.6
R44 330
R45 330
R46 47K
R47 47K
J4
tube.g1
tube.vd
tube.12V
tube.gnd
tube.g1
tube.g2
tube.g4
CRT-Socket
F5
F4
F3
F2
F1
Unused
U4C
U4D
U4F

	Initial	Date
Drawn	Rick Myers	Mar 4 1999
Designed	Rick Myers	Mar 4 1999
Checked	L.Phillips	3/9/99
Approved	Z.Psenicnik	3/9/99
Release For Production	J.Bello	3/9/99

Welch Allyn Inc.

Schematic: 620011.dsn

Title: CRT Deflection Board

Size C | Document Number 620011 | Rev D

Date: Friday, July 23, 1999 Sheet 1 of 1

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39179	JAC	3/18/99	LPP

+24V Boost (23.6 V nominal)

Temperature Amplifier

Printhead On/Off Switch

Thermistor Input

Printhead Connector

Connector Pin #	1	3	4	6
phase 1	+	+		
2		+	+	
3			+	+
4	+			+

	Initial	Date
Drawn	Rick Myers	Mar 5, 1999
Designed	Rick Myers	Mar 5, 1999
Checked	L.Phillips	3/22/99
Approved	Z. Psenicnik	3/19/99
Release For Production	J. Bello	3/19/99

Welch Allyn Inc.

Schematic: 620014.dsn

Title: Printer Electronics

Size C | Document Number 620014 | Rev A

Date: Monday, March 22, 1999 | Sheet 1 of 1

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39121	JAC	3/15/99	LPP
B	See ECN worksheet	5-39455	LPP	4/27/99	LPP
D	Mods to U2 clock line, Resp gain amp, ECG supply, and NVRAM pullup	5-39821	LPP	6/24/99	LPP
E	Improvements for ESD, RFI,and Fast Transients, Correct Respiration Diff-Amp Topology	5-39936	LPP	7/9/99	

Main PCA Connector

J4 — Socket 30x2

	1	2			
NIBP-Safety	3	4			
+3.3V	5	6	NIBP-PWM-ADC		
	7	8	RS423-Tx		
NIBP-OP	9	10	PIC-Data		
	11	12	RS423-Rx		
ETCO2-Tx	13	14	SPO2-Tx		
ETCO2-Rx	15	16	SPO2-Rx		
Spare-2	17	18	ADC-Clock		
NIBP-Data	19	20	FE-Clock		
NIBP-15mmHg	21	22	SPI-Data-Out		
LED-Latch	23	24	SPI-Clock		
Video-HSync	25	26	Batt-ID		
Spare-3	27	28	FE-Data		
Power-Sync	29	30	Rec-Motor-Step		
Vbackup	31	32			
NIBP-Valve-Close	33	34	PIC-Clk		
Video-VSync	35	36	Speaker-Audio		
NIBP-Offset-DAC	37	38			
	39	40	NIBP2-PW-ADC		
ac-on	41	42			
	43	44	Video-Data		
Key-Latch-n	45	46			
RS232-CTS	47	48	Nurse-Call		
Rec-Clock	49	50	Rec-Data-Latch		
	51	52	Rec-Strobe		
HRESET	53	54	SCL		
SPI-data-in	55	56	SCD		
	57	58			
	59	60			

Serial Data Out

U2 74HCT595

14	SER	QA	15 LED-On
		QB	1
11	SRCLK	QC	2
10	SRCLR	QD	3
		QE	4
12	RCLK	QF	5 Audio-Shutdown
13	G	QG	6 EROM-wr
		QH	7
8	GND	QH	9
16	VCC		

NIBP - Page 2

NIBP-A/D-SelC
NIBP-A/D-SelB
NIBP-A/D-SelA
NIBP-Pump-On
NIBP-ADC-Clock
NIBP-Safety
NIBP-15mmHg
NIBP-Overpressure
NIBP-Valve-Close
NIBP-PWM-ADC
NIBP-Offset-DAC

EKG - Page6

U1C 74HCT04 — EKG-PWM-ADC → FE-PWM-ADC
U1D 74HCT04 — EKG-Data-Clock → FE-Data-Clock (TP7)
U1E 74HCT04 — EKG-ADC-Clock → FE-ADC-Clock (TP8)
U1F 74HCT04 — FE-Data → FE-Data-In (TP9)

EKG - Page4

U1B 74HCT04 — Power-Sync → FE-Pwr-Sync (TP10)

SpO2 - Page4

U1A 74HCT04 — SPO2-Rx → SpO2Out (C23 .047uF)

Serial IO - Page8

U8A 74HCT04 — RS423Rx
U8B 74HCT04 — RS423Tx (TP5)
U8C 74HCT04 — NurseCall (TP6)
U8D 74HCT04
U8E 74HCT04
U8F 74HCT04

CO2 Board Connector

J3 CON4 — C40 .047uF, C41 1uF

CRT Board Connector

J6 CON6 — Video-VSync, Video-HSync, Video-Data

Fan Connector

J5 CON2 — C39 .047uF

Front Panel Display Connector

J8 CON14AP

Key-Clock-b	2	1	On/Off-Key
Key-Latch-n-b	4	3	+5V
Key-Data	6	5	
LED-Data-b	8	7	
LED-On	10	9	
	12	11	
LED-Latch-b	14	13	

C5 .047uF, C4 330uF

U3A 74HCT08 — Key-clock
U3B 74HCT08
U3C 74HCT08 — LED-Data
U3D 74HCT08

Recorder Board Connector

J7 CON24A

	1	2	
PIC-Vprog	3	4	Rec-Supply-On
	5	6	Rec-Motor-Step
Rec-Data-Latch	7	8	Rec-Strobe
Rec-Clock	9	10	Rec-Data
	11	12	
Rec+DCV	13	14	Rec+DCV
	15	16	Print-Temp
	17	18	
Rec-GND	19	20	Rec-GND
	21	22	
	23	24	

Rec-Supply-On, +12V (C14 .047uF), Rec+DCV, Print-Temp, Rec-GND; C20 .047uF

Speaker Drive

TP22 Audio-Shutdown; C35 4.7uF; C36 4.7uF; R17 19.6K; R17-1; TP23; R18 1.21K; TP25; U9 TPA301 (U9-3, U9-4); C37 0.1uF; R19 19.6K; TP24; C38 220pF; J11 CON3 — SP, SM — 4Vpp max.

Jumper wire from J4-20 to J4-55

Page1

ACON → R3 10K → Q2-b; Q2 MMBT3904L; R4 10K; q2-c; TP20; R21 10K; ac-on; Q3 2N7002

AC+12V-fuse; Q1 MMBT3906L (ACON-LED); R1 10K; Q1-e; TP19; R2 1.96K

D620361-MX10000

U10

(pg 1)			
PIC-Data	2	13	RB0
On/Off-Key	3	12	RB1
(Front Panel Key)	4	11	RB2 PIC-Clk
	5	10	RC0
On/Off	6	9	RC1 PIC-audio
(pg 3)			
U2-Reset	7	8	RC2 uP-RESET
(To U2)			

Vdd, Vss; ClkIn/Osc1/RB5, Clkout/Osc2/RB4, Vpp/MCLR/RB3, TC5/TOCK1, RC4, RC3

R25 1.21K; TP26; R5 19.6K; HRESET (To Processor); TP16

U7 AT24C02N-10SC-2.7

SDA, SCL; A0, A1, A2; WC; U7-wc; R23 1.21K; R24 1.21K; R15 1.96K; R16 3.48K; TP17; TP18

Power

Vbackup; C1 .047uF; C2 .047uF; C3 220pF; C42 .047uF; +3.3V; +5V; +12V

J1 CON7 — AC+12V, Rec-GND; J9 — Recorder ESD Ground, Tab-.187

J2 CON3 — R20 10K; Battery, Batt-ID

TP1 TP2 TP3 TP4; TP11; U2-Reset; C22 .047uF

R6 1.96K; C30 .047uF

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39121	JAC	3/15/99	LPP
B	See ECN worksheet	5-39455	LPP	4/27/99	LPP
D	Improvements for ESD, RFI, and Fast Transients, Correct Respiration Diff-Amp Topology	5-39821	LPP	6/24/99	LPP
E	Mods to U2 clock line, Resp gain amp, ECG supply and NVRAM pullup	5-39936	LPP	7/9/99	

Primary Transducer

0mmHG = 0.5V
300mmHG = 4.0V

P201
XFPM-050KPGR-P1

Gain and Comp

Zero Adjust
+/-20mmHg range

PWM D/A
76.8KHz

NIBP-Offset-DAC

Safety Transducer

P202
FPNS-07PGR

Zero Offset

Over Pressure Fault Circuit

NIBP-Overpressure
NIBP-15mmHg

A/D Mux

BattCurrent
BattVoltage
Print-Temp
P4.25V
P.75V
PrimaryPres
SafetyPres
+5V/2

NIBP-A/D-SelC
NIBP-A/D-SelB
NIBP-A/D-SelA

NIBP PWM A/D Converter

PWM A/D Converter

NIBP-ADC-Clock
NIBP-PWM-ADC

NIBP-Safety

Valve+
Valve-
Pump+
Pump-
CON5

NIBP-Valve-Close
NIBP-Pump-On

	Initial	Date
Drawn	Rick Myers	Mar 5, 1999
Designed	Rick Myers	Mar 5, 1999
Checked	L. Phillips	3/16/99
Approved	Z. Psenicnik	3/16/99
Release For Production	J. Bello	3/16/99

Welch Allyn Inc.

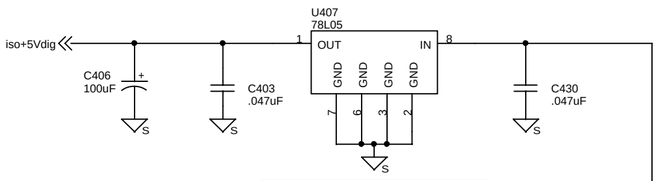
Schematic: 620017.dsn

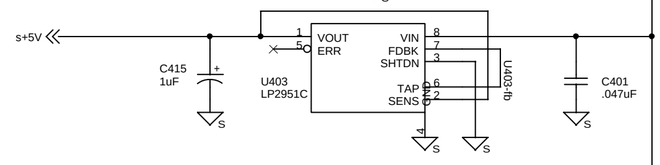
Title: NIBP ELECTRONICS

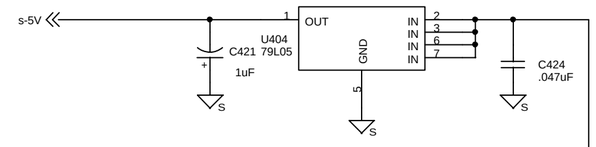
Size: C | Document Number: 620017 | Rev: E

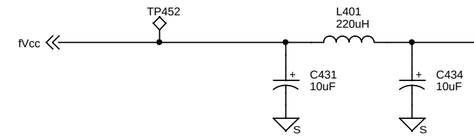
Date: Tuesday, July 13, 1999 | Sheet 2 of 8

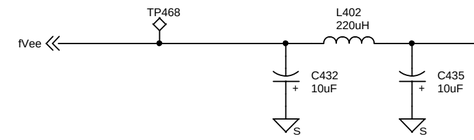
REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39121	JAC	3/15/99	LPP
B	See ECN worksheet	5-39455	LPP	4/27/99	LPP
D	Improvements for ESD, RFI, and Fast Transients, Correct Respiration Diff-Amp Topology	5-39821	LPP	6/24/99	LPP
E	Mods to U2 clock line, Resp gain amp, ECG supply and NVRAM pullup	5-39936	LPP	7/9/99	





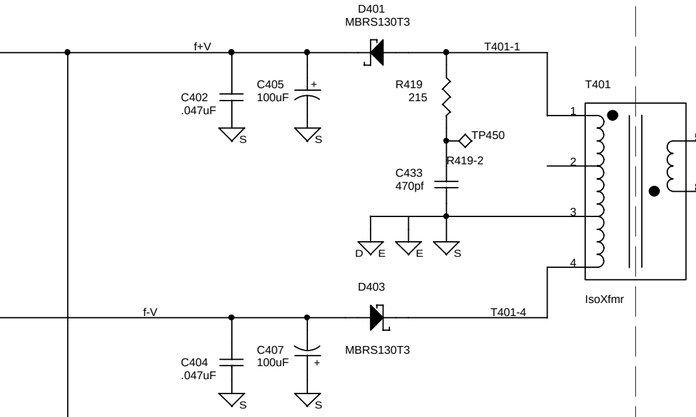




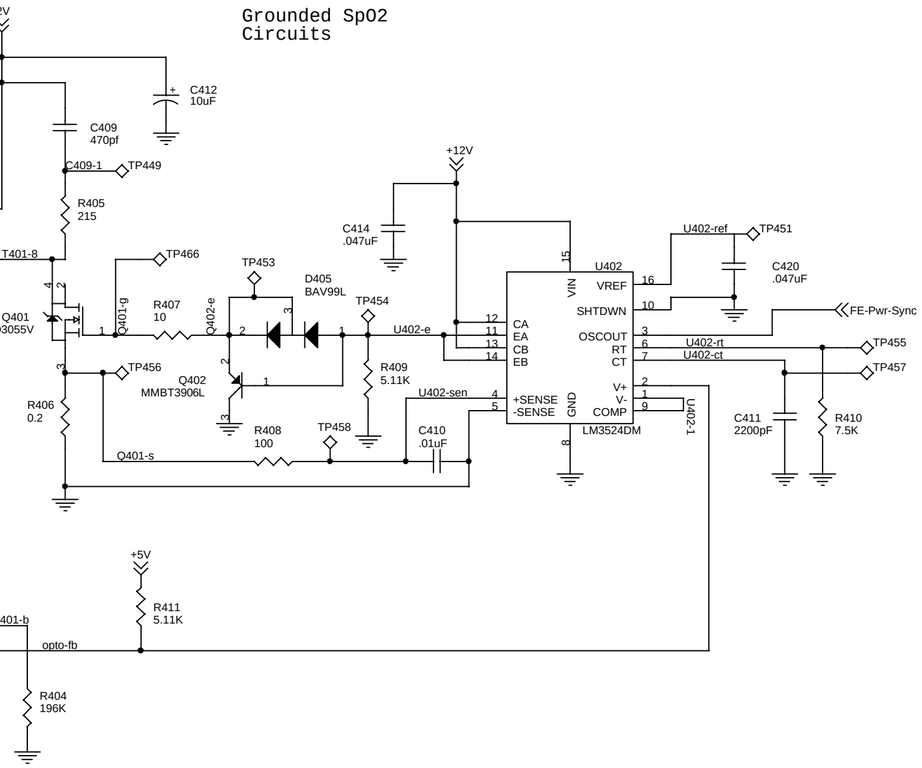


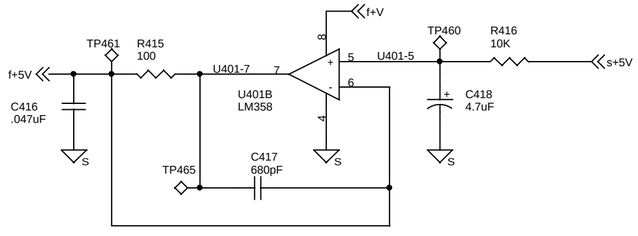
Isolation Barrier

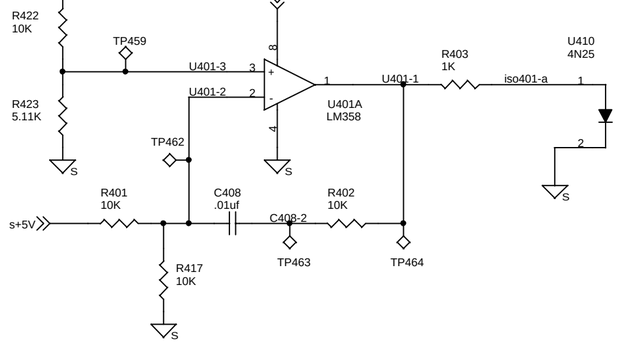
Isolated SpO2 Circuits



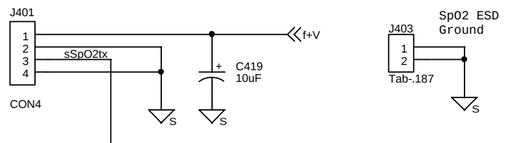
Grounded SpO2 Circuits



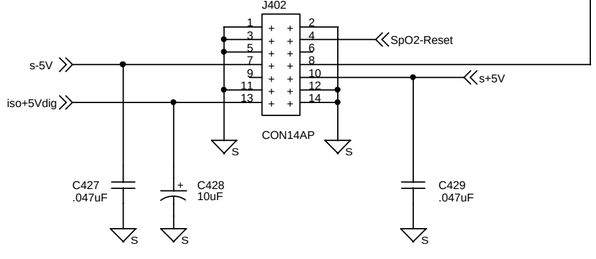


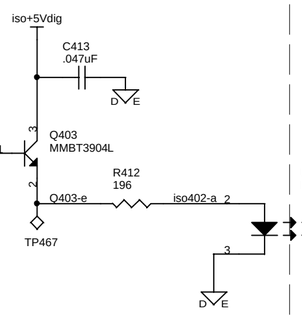


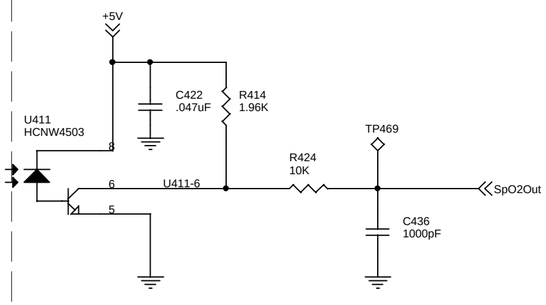
Nonin SpO2 Connector



Nellcor SpO2 Connector







	Initial	Date
Drawn	Rick Myers	Mar 5, 1999
Designed	Rick Myers	Mar 5, 1999
Checked	L. Phillips	3/16/99
Approved	Z. Psenicnik	3/16/99
Release For Production	J. Bello	3/16/99

Welch Allyn Inc.

Schematic: 620017.dsn

Title: Power Isolation and SpO2 Interface

Size: C | Document Number: 620017 | Rev: E

Date: Tuesday, July 13, 1999 | Sheet 4 of 8

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39121	JAC	3/15/99	LPP
B	See ECN worksheet	5-39455	LPP	4/27/99	LPP
D	Improvements for ESD, RFI, and Fast Transients, Correct Respiration Diff-Amp Topology	5-39821	LPP	6/24/99	LPP
E	Mods to U2 clock line, Resp gain amp, ECG supply and NVRAM pullup	5-39936	LPP	7/9/99	

U702 U703

fVcc
C715 .047uF
C716 .047uF
fVee
C717 .047uF
C718 .047uF

f+5V
U701B 74HC74

Respiration Drive Circuit

-Clamp +Clamp
D701 MMBD1503A
R701 1.96K
Right-Arm
C701 1000pF
TP702 C701-1
R703 31.6K
TP703 RespDr+
TP701
D702 MMBD1503A
R702 1.96K
Left-Arm
C702 1000pF
TP705 C702-1
R704 31.6K
RespDr-
TP704
TP706
f+5V
C719 4.7uF
U701A 74HC74
Resp-Off
resp-clk
TP723
R725 2.15K
C721 100pF
u710-6
iso+5Vdig
R705 2.15K
C705 0.1uF
U710 HCNW4503
+5V
iso701-a
R706 215
FE-Pwr-Sync

Isolation Barrier

D703 MMBD1503A
R707 1.96K
C706 330pF
TP708 U702-3
R709 464K
TP710
TP714
fVcc
Respiration Diff Amp
U702A AD712
R711 15.8K
TP709
R712 1K
fVee U702-2
R715 3.16K
TP711
R716 3.16K
U702-1
D705 MMBD354LT1
U703-2
U703A AD712
D703-1
TP716
D704 MMBD1503A
R708 1.96K
C707 330pF
TP720 U702-5
D704-3
TP721
R710 464K
U702B AD712
U702-7 TP722
R713 1K
U702-6
TP715
R714 15.8K
d705-c
R724 196K
TP707 Resp-DC
C720 .047uF
B.W. = .06Hz to 16 Hz
R717 3.16K
C711 0.1uF
C712 3.3uF
Resp-AC
R718 825K
R719 51.1K
Q701-d
TP718
Q701 MMBF4393L
TP719
Q701-b
R720 100K
TP712
U703-5
C713 0.1uF
fVcc
Gain =1000
B.W. = 10Hz
U703B AD712
TP713 An-Resp
U703-6
TP717
R721 316K
R722 316
C714 .047uF
D706 MMBD1503A
Resp-Reset
R723 1Meg

	Initial	Date
Drawn	Rick Myers	Mar 5, 1999
Designed	Rick Myers	Mar 5, 1999
Checked	L. Phillips	3/16/99
Approved	Z. Psenicnik	3/16/99
Release For Production	J. Bello	3/16/99

Welch Allyn Inc.

Schematic: 620017.dsn

Title: Respiration

Size C | Document Number 620017 | Rev E

Date: Wednesday, July 14, 1999 Sheet 7 of 8

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39121	JAC	3/15/99	LPP
B	See ECN worksheet	5-39455	LPP	4/27/99	LPP
D	Improvements for ESD, RFI, and Fast Transients, Correct Respiration Diff-Amp Topology	5-39821	LPP	6/24/99	LPP
E	Mods to U2 clock line, Resp gain amp, ECG supply and NVRAM pullup	5-39936	LPP	7/9/99	

On/Off Switch

Rec+DCV, Q303 MTP30N06VL, U307 LP2951CD-3.3 (VIN, FDBK, SHTDN, TAP, SENS, VOUT, ERR), C331 4.7uF, C332 4.7uF, VBackup, V+18V

On/Off Circuit
18V Boost - Mosfet Gate Voltage

U301 MC34063AD (IPK, Vcc, TCAP, GND, IDC, ISWC, ISWE, COMP), U301-7, L301 1mH, D302 BAV99L, R305 1, R306 61.9K, C304 100uF, TP309, TP310, R307 4.64K, C303 470pf, U301-sw, U301-pwr, U301-ct, U301-comp

Heatsink for D301: HS301 6078

+Vfuse, F303 4Amp, AC+12V, Battery, D301 MBR2535CTL, C301 330uF

Q301 MPSW51A, R301 10K, Q301-b, C302 1uF, R302 1.96K

On/Off, R303 51.1K, C339-1, R304 100K, Q302-B, Q302-c, Q302 MMBT3904L, TP313, TP314, TP354, C339 1uF, D313 NO LOAD

+12V Boost
(12.1V nominal)

Q303-s, C335 .047uF, L303 Bead, L302-1, L302 22uH, D303 5.1V, U302-pwr, C306 1uF, C310 1000uF, R308 17.8K, TP302, U302-fb, R309 4.64K, TP305, R310 10K, C305-1, C305 5600pF, TP304, U302 UC3843A (VFB, COMP, VREF, RT/CT, PWR-GND, GND, Vcc, Vc, OUT, ISENSE), TP307, TP306, U302-comp, 5VRef, C307 .047uF, R311 10K, C308 2200pF, TP311, U302-ct, Q304-e, Q304 MMBT3904L, TP312, R312 3.83K, R313 1.96K, U302-out, R314 10, TP308, R315 196, C309 5600pF, U302-sense, Q305-g, Q305-s, Q305 MTP30N06VL, R316 0.1, D304 MBRS340T3, Q305-d, D304-C, L305 Bead, C311 1000uF, C312 1000uF, C336 .047uF, C313 330uF, +12V

D312 BAV99L, AC+12V-fuse, D312-c, R317 7.5K, TP315, TP316

F301 4Amp, Bat-fuse

Battery Charger

F302 4Amp, TP349, F302-2, L306 Bead, C340 .047uF, C337 .047uF, AC+12V-fuse, C318 330uF, Q308 MTP23P06V, Q308-g, Q308-d, L304 47uH, D306 MBRS340T3, C319 1000uF, C319-1, C338 .047uF, R327 0.1, TP353, D307 MBRS340T3, D307-A

Q307 MMBT3904L, Q307-e, TP320, R325 1.96K, R326 10, D305 BAV99L, TP326, Q306-c, C314 .047uF

R318 10K, TP324, U303-fb, R319 19.6K, TP351, U303 UC3843A (VFB, COMP, VREF, RT/CT, PWR-GND, GND, Vcc, Vc, OUT, ISENSE), U303-cp, U303-ct, U303-out, U303-5, R323 1.96K, Q306-b, Q306 MMBT3904L, TP328, TP329, C315 .047uF, R320 7.5K, C316 2200pF, TP333, R321 27.4K, TP335, R322 10K, R324 10K, ACON, Ref-Batcharge

R328 1K, R329 1K, TP321, TP322, R331 33.2K, R330 33.2K, U305-6, U305-5, U305B MC34072

Current Limit
(1.5 Amp)

TP330, C320 .01uF, U304-2, R332 19.6K, Ref-Batcharge, TP332, U304-1, D308 BAV99L, TP336, R333 19.6K, TP337, U304-3, U304A MC34072, C322 .047uF, AC+12V-fuse, I-Batt

Batt-fb, TP341, TP342, R339 19.6K, R339-2, C321 .01uF, R334 19.6K, Ref-Batcharge, TP345, R340 10K, U304-7, U304-6, U304-5, TP352, R335 4.32K, TP346, R336 7.5K, TP348, RT301 10K, RT301-1, Q309-3, U304B MC34072, AC+12V-fuse, R337 8.87K, Bat-Adj, R338 1K

Q309 MMBT3906L, Q309-b, TP347, R341 10K, R342 19.6K, TP339, +12V, R343 10K, R343-1, TP355, D309 BAV70L

R344 10K, TP350, ACON, Q310-b, Q310 MMBT3904L, Q310-c, R345 10K

Float Voltage

+5V Linear Low Dropout

D310 MBRS340T3, Q311 MTP30N06VL, HS302 6078, Heatsink forQ312, Q312 MTP30N06VL, +Vpump, +5V, C323 100uF, Q312-g, R346 100, C324 1000pF, TP317, C324-2, R347 10K, TP319, TP318, R348 10K, C325 100uF, U305-1, U305-2, U305A MC34072, TP323, R349 10K, U305-3, 5VRef, C326 .01uF, R350 10K, C327 .047uF, D311 BAV70L, +12V, AC+12V-fuse, U305-pwr, TP331

U306 LF33CV (IN, GND, OUT), C328 .047uF, C329 100uF, C330 .047uF, +3.3V

Q313 2N7002, TP334, TP338, Q313-d, R351 5.11K, BattVoltage, R352 5.11K, C333 .047uF, +12V, TP340, TP343, Q314-d, R353 5.11K, Q314 2N7002, BattCurrent, R354 5.11K, R355 14.7K, C334 .047uF, +5V

Ibatt=0: BattCurr=0.74V
Ibatt=1.5: BattCurr=2.87V

	Initial	Date
Drawn	Rick Myers	Mar 5, 1999
Designed	Rick Myers	Mar 5, 1999
Checked	L. Phillips	3/16/99
Approved	Z. Psenicnik	3/16/99
Release For Production	J. Bello	3/16/99

Welch Allyn Inc.

Schematic: 620017.dsn

Title: DC/DC Power Supplies

Size C | Document Number 620017 | Rev E

Date: Tuesday, July 13, 1999 | Sheet 3 of 8

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39121	JAC	3/15/99	LPP
B	See ECN worksheet	5-39455	LPP	4/27/99	LPP
D	Improvements for ESD, RFI, and Fast Transients, Correct Respiration Diff-Amp Topology	5-39821	LPP	6/24/99	LPP
E	Mods to U2 clock line, Resp gain amp, ECG supply and NVRAM pullup	5-39936	LPP	7/9/99	

fVcc
fVee
U501 U502 U503 U504 U505 U506 U507 U508
C534 4.7uF C518 .047uF C520 .047uF C522 .047uF C524 .047uF C526 .047uF C528 .047uF C530 .047uF C532 .047uF
C535 4.7uF C519 .047uF C521 .047uF C523 .047uF C525 .047uF C527 .047uF C529 .047uF C531 .047uF C533 .047uF

Defib Protect
RFI Filtering
+clamp
-clamp
R506 10K
R507 10K
TP501
TP502
D506 5.1V
D507 5.1V

Input Buffers
Gain = 9.26

J501 CON6
Right-Arm
Left-Arm
Shield
D501 MMBD1503A
D502 MMBD1503A
D503 MMBD1503A
D504 MMBD1503A
D505 BAV99L
R501 51.1K
R502 51.1K
R503 51.1K
R504 51.1K
R505 51.1K
N501 LAMP NEON
N502 LAMP NEON
N503 LAMP NEON
N504 LAMP NEON
N505 LAMP NEON
C501 220pF
C502 220pF
C503 220pF
C504 220pF
C505 220pF
TP503 TP504 TP505 TP506 TP507 TP508 TP509 TP510 TP511 TP512 TP513 TP515 TP516 TP519 TP520 TP521 TP523 TP524 TP525 TP531 TP533 TP535 TP536 TP537 TP538 TP539 TP540 TP542 TP543 TP548 TP549 TP550 TP551 TP552 TP555 TP556 TP559 TP560 TP561
R508 10K
R509 22Meg
R509-1
R557 22Meg
R510 10K
R511 22Meg
R511-1
R558 22Meg
R512 10K
R513 22Meg
R513-1
R559 22Meg
R514 10K
R515 22Meg
R515-1
R560 22Meg
VLdsOff
C506 220pF
C507 220pF
C508 220pF
C509 220pF
U501-3 U501-5 U502-3 U502-5
U501A MC34002
U501B MC34002
U502A MC34002
U502B MC34002
U501-2 U501-6 U502-2 U502-6
R517 10K 0.1%
R518 1.21K 0.1%
R519 10K 0.1%
R520 1.21K 0.1%
R521 10K 0.1%
R522 1.21K 0.1%
R523 10K 0.1%
R524 1.21K 0.1%
C510 220pF
C511 220pF
C512 220pF
C513 220pF
Q501 2N7002
Q502 2N7002
Q501-S
Sw-RLD-V
Sw-RLD-RL
Sw-RLD-LL
Sw-RLD-LA
Sw-RLD-RA
U504
S1 S2 S3 S4
D1 D2 D3 D4
IN1 IN2 IN3 IN4
V+ V- GND
DG202CSE
RL-mux
R516 10K
RLD Amp
U503A MC34002
U503B MC34002
U503-2 U503-5
R525 10K
R526 10K
R527 1K
R528 51.1K
C514 0.1uF
C514-2
VLdsOff
f+1.24V
R555 30.1K
R556 10K
C536 .01uF
f+5V

A/D Inputs
Leads Off
RA
LA
LL
V+

Wilson
Network
R529 10K
R530 10K
R531 10K
R532 10K
R533 10K
R534 10K
R535 10K
R536 10K
R537 10K

Lead Select
U505 4051
U506 4051
RA LA aVR aVL aVF V-
INH A B C VEE VSS
Mux-LdS-A
Mux-LdS-B
Mux-LdS-C

U507A MC34002
U507B MC34002
mux- mux+ diff- diff+

Diff Amp
Gain = 1
R544 10K 0.1%
R546 10K 0.1%
C544 1000pF
U508-3
U508A AD712
U508-2
R545 10K 0.1%
R547 10K 0.1%
C542 220pF
C545 1000pF
TP514 TP522 TP528 TP529 TP557 TP558
R565 121K
C543 .047uF
U509-4
U501-8
U509 LMC7101
diff-out

High Pass (0.05Hz or 0.5Hz)
Low Pass (150Hz)
Gain Stage
Gain = 74
C515 3.3uF
ecg-hp
R550 19.6K
U508-5
U508B AD712
C516 .047uF
R548 1Meg
R549 110K
Q504-d
U508-6
R551 73.2K
C517 .01uF
R552 1K
An-ECG
TP517 TP518 TP526 TP527 TP530 TP532
Q504 2N7002
Q504-s
Q504-g
Q505 2N7002
R553 100K
Sw-MonBw

	Initial	Date
Drawn	Rick Myers	Mar 5, 1999
Designed	Rick Myers	Mar 5, 1999
Checked	L. Phillips	3/16/99
Approved	Z. Psenicnik	3/16/99
Release For Production	J. Bello	3/16/99

Welch Allyn Inc.
Schematic: 620017.dsn
Title: ECG Amp
Size C | Document Number 620017 | Rev E
Date: Wednesday, July 14, 1999 Sheet 5 of 8

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39121	JAC	3/15/99	LPP
B	See ECN worksheet	5-39455	LPP	4/27/99	LPP
D	Improvements for ESD, RFI, and Fast Transients, Correct Respiration Diff-Amp Topology	5-39821	LPP	6/24/99	LPP
E	Mods to U2 clock line, Resp gain amp, ECG supply and NVRAM pullup	5-39936	LPP	7/9/99	

Isolation Barrier

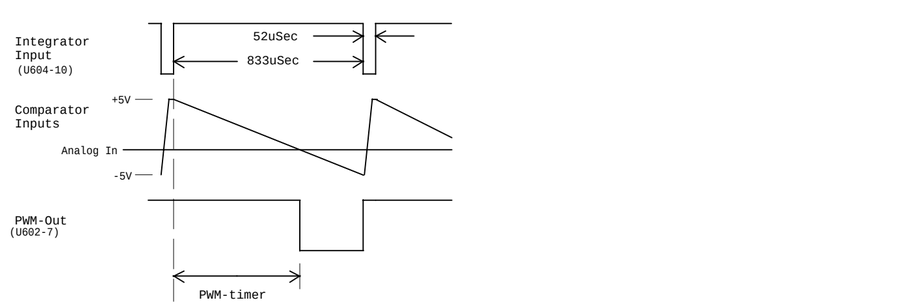
Serial/Parallel Control Data

Temperature Amplifier

Temperature Thermistor

A/D Mux

PWM A/D Converter



	Initial	Date
Drawn	Rick Myers	Mar 5, 1999
Designed	Rick Myers	Mar 5, 1999
Checked	L. Phillips	3/16/99
Approved	Z. Psenicnik	3/16/99
Release For Production	J. Bello	3/16/99

Welch Allyn Inc.

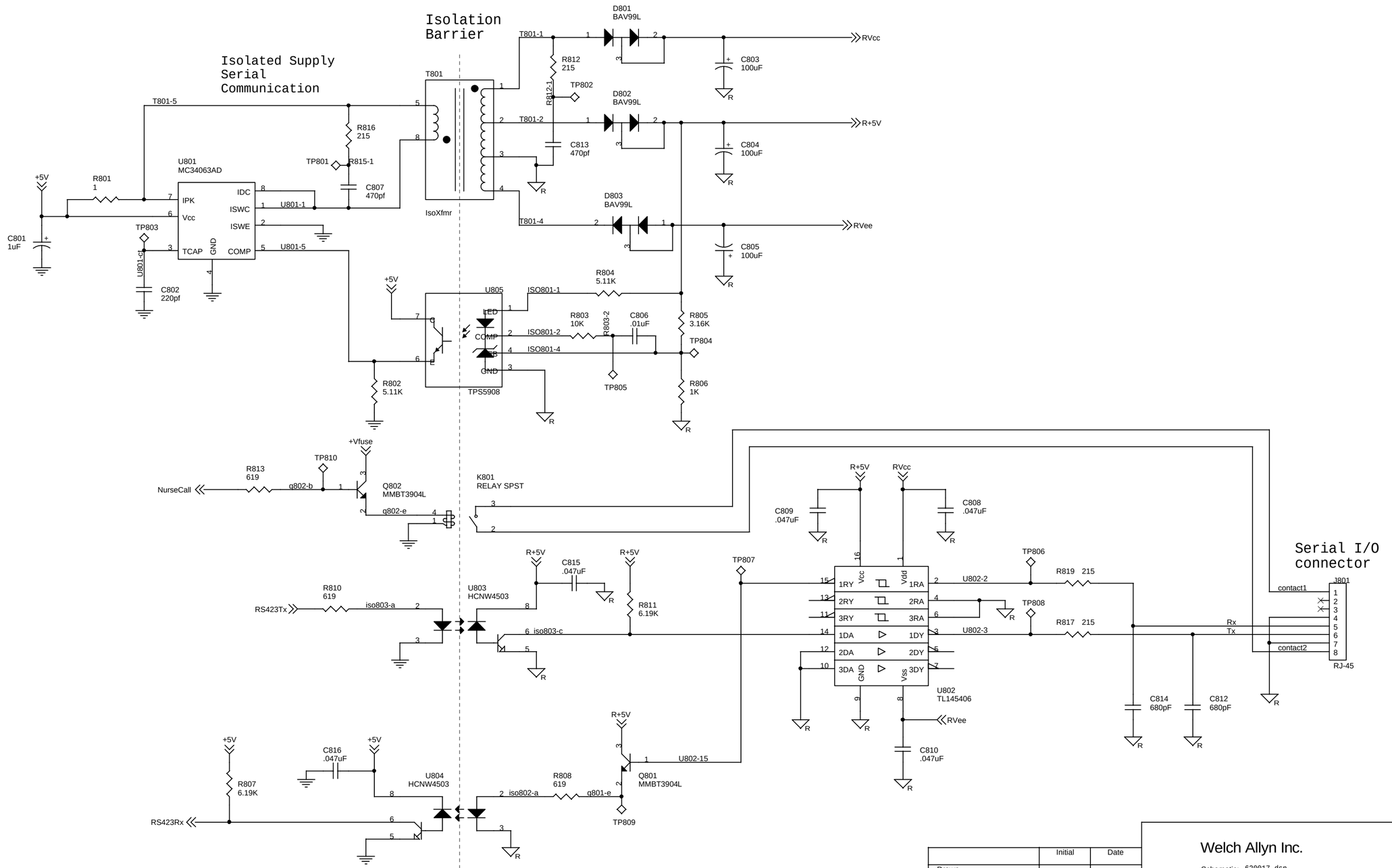
Schematic: 620017.dsn

Title: ECG A/D and Interface

Size: C | Document Number: 620017 | Rev: E

Date: Wednesday, July 14, 1999 | Sheet 6 of 8

REV	Description	ECN/ECO	Init	Date	Ckd
A	Release to Production	5-39121	JAC	3/15/99	LPP
B	See ECN worksheet	5-39455	LPP	4/27/99	LPP
D	Improvements for ESD, RFI, and Fast Transients, Correct Respiration Diff-Amp Topology	5-39821	LPP	6/24/99	LPP
E	Mods to U2 clock line, Resp gain amp, ECG supply and NVRAM pullup	5-39936	LPP	7/9/99	



	Initial	Date
Drawn	Rick Myers	Mar 5, 1999
Designed	Rick Myers	Mar 5, 1999
Checked	L. Phillips	3/16/99
Approved	Z. Psenicnik	3/16/99
Release For Production	J. Bello	3/16/99

Welch Allyn Inc.

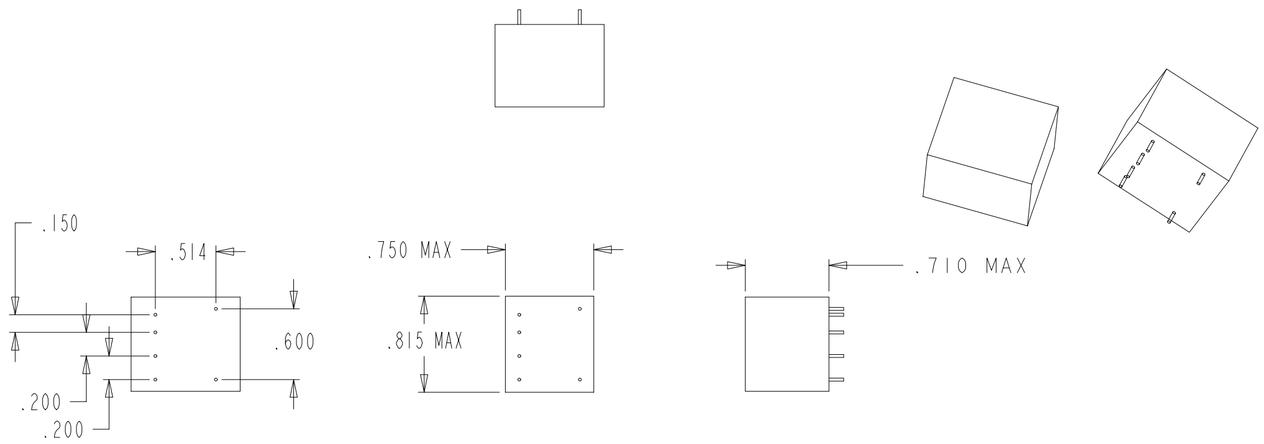
Schematic: 620017.dsn

Title: Serial Communication

Size C | Document Number 620017 | Rev E

Date: Wednesday, July 14, 1999 | Sheet 8 of 8

REV	DESCRIPTION	ECN/ECO	INIT	DATE	CKD
A	RELEASE TO PROD. ENG.	5-39342	JRS	4/08/99	T.W.



PCB
HOLE PATTERN

NOTES:

1. MANUFACTURER: ZMAN MAGNETIC
   BEAVERTON OREGON

2. TRANSFORMER MUST MEET UL CONSTRUCTION TECHNIQUES.

3. LABELING: THE TRANSFORMER SHALL BE LABELED, AND INCLUDE THE FOLLOWING:

   - MANUFACTURER'S NAME
   - WELLCH ALLYN PART NUMBER I.E. 620020
   - DATE CODE: YYWW (OR APPROVED ACCEPTABLE FORM)

4. SCHEMATIC AS NOTED.

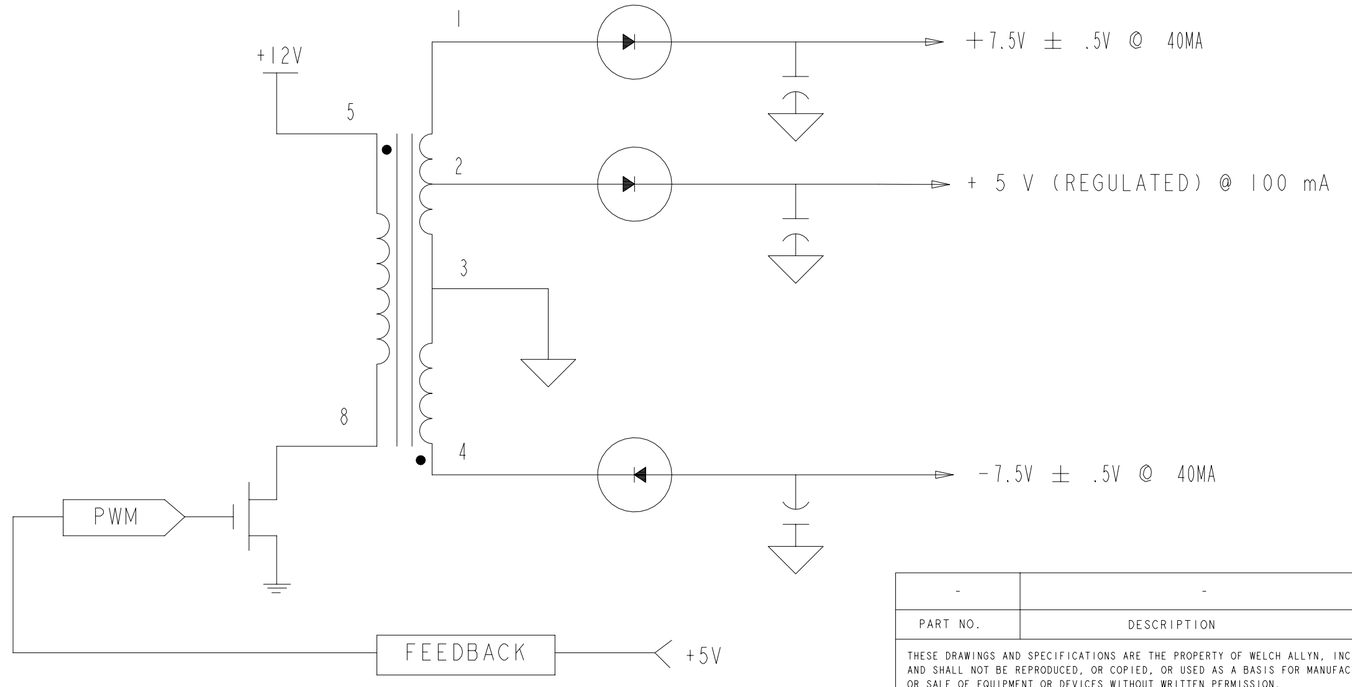
5. SPECIFICATIONS:

ISOLATION CAPACITANCE	:	< 7.5 pF
VOLTAGE BREAKDOWN	:	> 8 KV DC
INPUT	:	+12 V DC
OUTPUT 1	:	+7.5 V þ 0.5 V @ 40 mA
OUTPUT 2	:	+5 V @ 100 mA (REGULATED)
OUTPUT 3	:	-7.5 V þ 0.5 V @ 40 mA
SWITCHING FREQUENCY	:	76.8 kHZ
OPERATING MODE	:	DISCONTINUOUS
PRIMARY WINDING	:	PIN 5 TO PIN 8
INDUCTANCE	:	135 uH þ 10%
RESISTANCE	:	0.15 OHMS þ 15%
SECONDARY WINDING	:	PIN 1 TO PIN 4
INDUCTANCE	:	380 uH þ 10%
RESISTANCE	:	0.25 OHMS þ 15%

6. THE FOLLOWING TESTS TO BE PERFORMED ON 100% OF THE PARTS AND WRITTEN CERTIFICATION TO BE SUPPLIED WITH EACH LOT:

   A. PRIMARY INDUCTANCE (PIN 5 TO PIN 8).
   B. SECONDARY INDUCTANCE (PIN 1 TO PIN 4).
   C. TURNS RATIO1 1-4 TO 5-8.
   D. VOLTAGE BREAKDOWN.

7. PART TO BE A RECOGNIZED COMPONENT UNDER UL2601 OR EN60601.1 CONSTRUCTION.



CIRCUIT SCHEMATIC

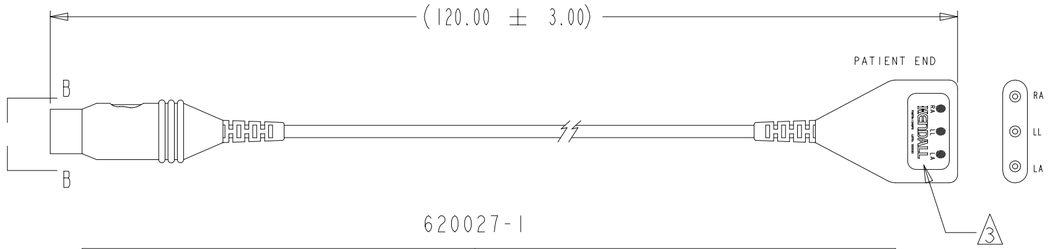
-	-
PART NO.	DESCRIPTION

DRAWN: WJM	DATE: 01-Apr-99	Welch Allyn®
APPROVED: ZIP	DATE: 4/08/99	MATERIAL: -
REL TO PROD: J. BELLO	DATE: 4/08/99	FINISH: -
-	-	TITLE: TRANSFORMER ISOLATION
CAD SOFTWARE:	PROE	
TRANSLATED FROM:	ME10	

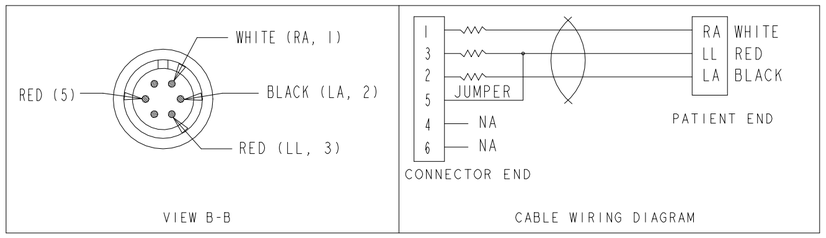
UNLESS OTHERWISE SPECIFIED
TOLERANCES .XX = ±.02 .XXX = ±.005 ANGLES ±2°
DIMENSIONS ARE IN INCHES

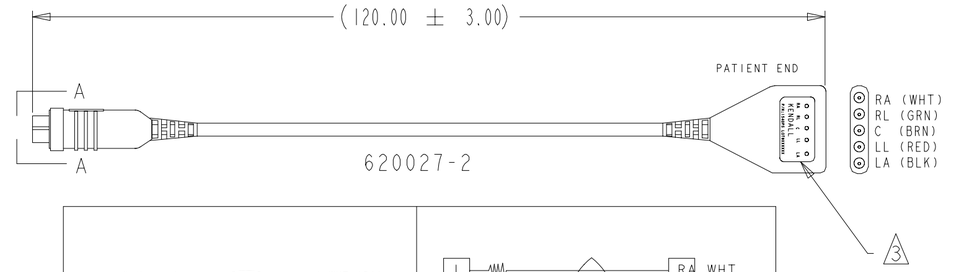
C	DRAWING NO. 620020	REV A
SCALE FULL	SHEET 1 of 1	

REV	DESCRIPTION	ECN/ECO	INIT	DATE	CKD
A	RELEASE TO PROD. ENG.	5-39391	JRS	4/16/99	T.W.
B	ADD 620027-3,-4 (IEC) CHANGE NOTES 3,4	5-39935	ASK	7-8-99	S.S.

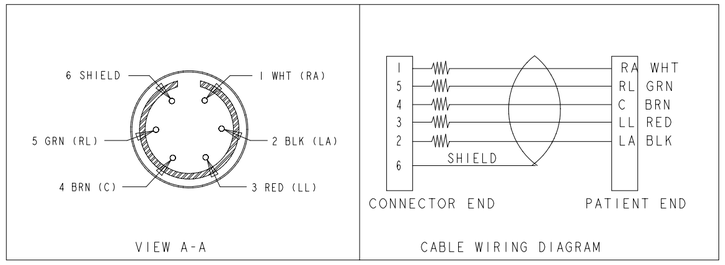


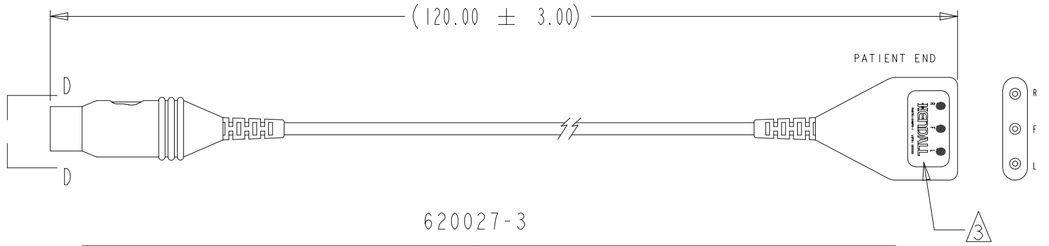
620027-1



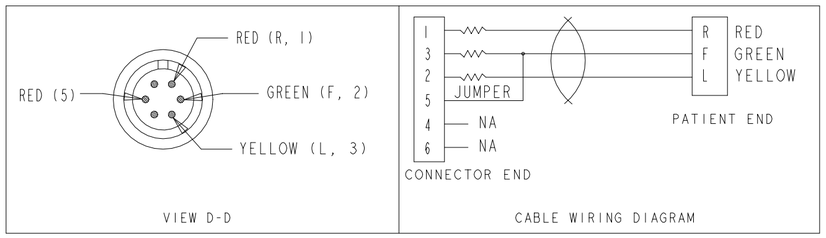


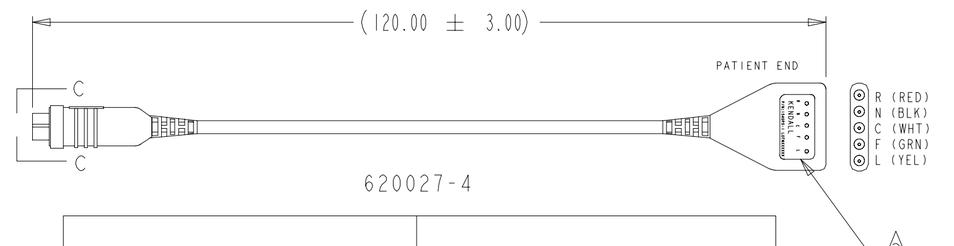
620027-2



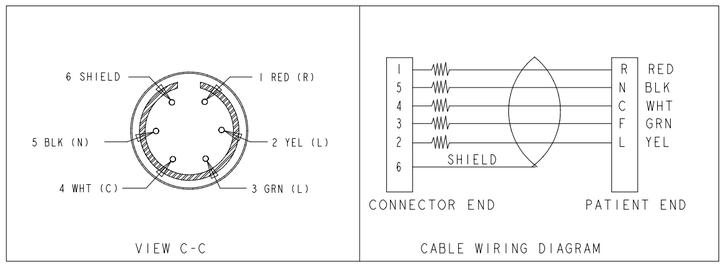


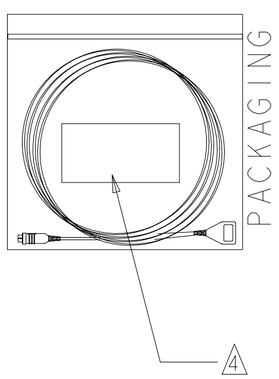
620027-3





620027-4





	CATALOG P/N	REF P/N	DESCRIPTION	
620027-1	1340PS	MW02500	3-LEAD; DIN STYLE SAFETY PATIENT CABLE; COLOR CODE:W,R,BL	5
620027-2	1540PS	MW03775	5-LEAD; DIN STYLE SAFETY PATIENT CABLE; COLOR CODE:W,G,BR,R,BL	6
620027-3	1340PS-1		3-LEAD, DIN STYLE SAFETY PATIENT CABLE IEC COLOR CODE: R,G,Y	8
620027-4	1540PS-1		5-LEAD, DIN STYLE SAFETY PATIENT CABLE IEC COLOR CODE: R,B,W,G,Y	9

NOTES:

1. CONNECTOR AND TRUNK CABLE SHALL BE 414C GRAY AND THE PATIENT END SHALL BE BLACK.

2. ELECTRICAL RESISTANCE SHALL BE BETWEEN 900 AND 1100 OHMS.

3. CABLE NAMEPLATE SHALL CONTAIN:
   KENDALL
   (B) PART NUMBER: SEE TABLE - CATALOG P/N
   LOT NUMBER: XXXXXX

4. PACKAGING BAG LABEL SHALL CONTAIN:
   KENDALL
   (B) CATALOG NUMBER: SEE TABLE
   PART NUMBER: SEE TABLE - REF P/N
   DESCRIPTION: SEE TABLE
   QUANTITY: 1 EACH
   LOT NUMBER: XXXXXX

5. CHANNEL DESIGNATIONS: RA=WHITE, LL=RED, LA=BLACK; WITH 1 K OHM RESISTORS; WIRING PER ANSI/AAMI 1983 ECG CONNECTOR STANDARD; (COMPLIANT WITH ANSI/AAMI EC53-1995 CABLE AND LEAD STANDARD)

6. CHANNEL DESIGNATIONS: RA=WHITE, RL= GREEN, C=BROWN; LL=RED, LA=BLACK; WITH 1 K OHM RESISTORS; WIRING PER ANSI/AAMI 1983 ECG CONNECTOR STANDARD; (COMPLIANT WITH ANSI/AAMI EC53-1995 CABLE AND LEAD STANDARD)

7. CABLE MUST MEET THE PERFORMANCE STANDARD FOR ELECTRODE LEAD WIRES AND PATIENT CABLES FOUND IN TITLE 21 CFR, PART 898

8. (B) CHANNEL DESIGNATIONS: R=RED, F=GREEN, L=YELLOW; WITH 1 K OHM RESISTORS; WIRING PER ANSI/AAMI 1983 ECG CONNECTOR STANDARD; (COMPLIANT WITH ANSI/AAMI EC53-1995 CABLE AND LEAD STANDARD)

9. (B) CHANNEL DESIGNATIONS: R=RED, N=BLACK, C=WHITE; F=GREEN, L=YELLOW; WITH 1 K OHM RESISTORS; WIRING PER ANSI/AAMI 1983 ECG CONNECTOR STANDARD; (COMPLIANT WITH ANSI/AAMI EC53-1995 CABLE AND LEAD STANDARD)

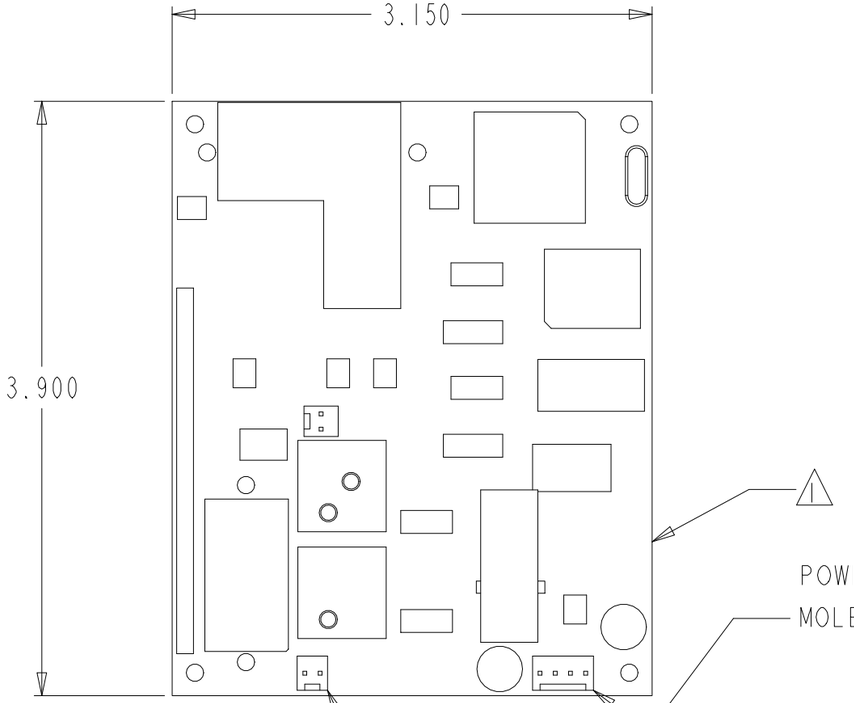
-	-
PART NO.	DESCRIPTION

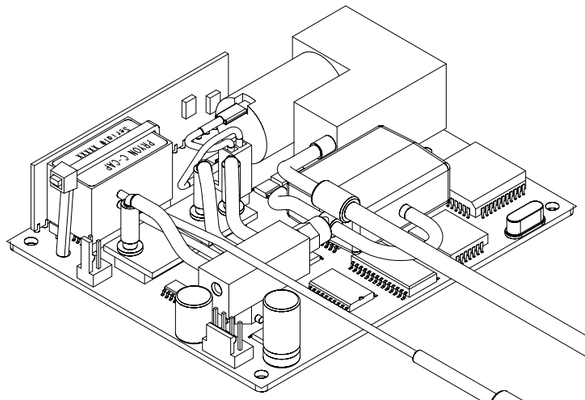
DRAWN JB ENGEL	DATE 09-Apr-99	Welch Allyn®
APPROVED ZIP	DATE 4/16/99	MATERIAL: -
REL TO PROD J. BELLO	DATE 4/16/99	FINISH: -
-	-	TITLE: ECG PATIENT CABLE
CAD SOFTWARE:	PRO E	
TRANSLATED FROM:		

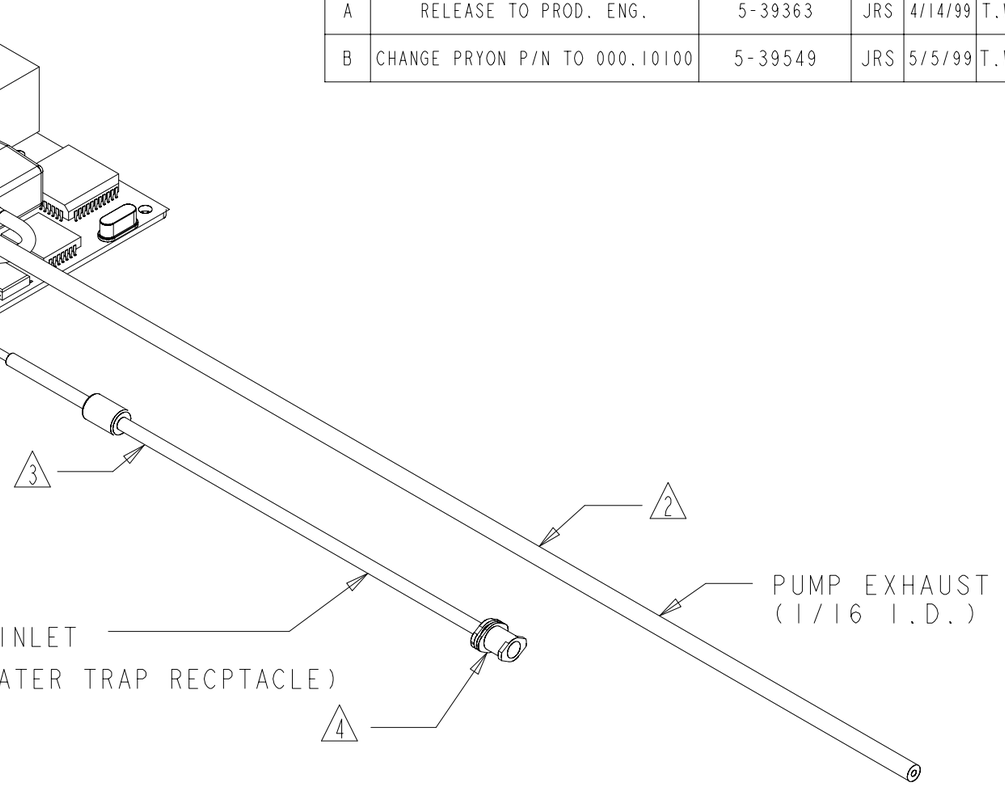
UNLESS OTHERWISE SPECIFIED
TOLERANCES DIMENSIONS ARE IN INCHES
.XX = ±.02
.XXX = ±.005
ANGLES ±2°

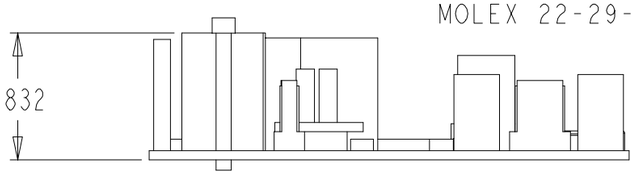
C	DRAWING NO. 620027	REV B
SCALE NONE	SHEET 1 of 1	

REV	DESCRIPTION	ECN/ECO	INIT	DATE	CKD
A	RELEASE TO PROD. ENG.	5-39363	JRS	4/14/99	T.W.
B	CHANGE PRYON P/N TO 000.10100	5-39549	JRS	5/5/99	T.W.









NOTES:

1. PRYON LC-101 GENERIC SUBASSEMBLY P/N 000.10100 (B)

2. NOMINAL LENGTH (FROM PUMP BODY TO TUBING EXHAUST)
   13.4 INCHES.

3. NOMINAL LENGTH (FROM SENSOR BODY TO FEMALE LUER INLET)
   9.8 INCHES.

4. WATERTRAP AND WATERTRAP RECEPTACLE REQUIRED FOR OPERATION.

5. PACKAGING TO BE APPROVED BY WELCH ALLYN. HANDLING AND PACKAGING TO PREVENT DAMAGE DUE TO ESD, BENDING AND OTHER DAMAGE.

-	-
PART NO.	DESCRIPTION

DRAWN: WJM	DATE: 01-Apr-99	Welch Allyn®
APPROVED: ZIP	DATE: 4/14/99	MATERIAL: -
REL TO PROD: J. BELLO	DATE: 4/14/99	FINISH: -
-	-	TITLE: ETCO2 PCB ASSEMBLY
CAD SOFTWARE:	PROE	
TRANSLATED FROM:	ME10	

UNLESS OTHERWISE SPECIFIED
TOLERANCES: .XX = ±.02, .XXX = ±.005, ANGLES ±2°
DIMENSIONS ARE IN INCHES

B	DRAWING NO. 620032	REV B
SCALE NONE	SHEET 1 of 1	

REV	DESCRIPTION	ECN/ECO	INIT	DATE	CKD
B	SEE ECN (REV A REL. AS EXT ITM MSTR)	5-39954	ASK	7-12-99	T.W.

PERFORMANCE SPECIFICATIONS	
INPUT VOLTAGE	90 - 264 Vac
INPUT FREQUENCY	47 - 63 Hz
INPUT CURRENT (FULL LOAD)	1.6 A
OVERVOLTAGE PROTECTION	14 ±1.1 V
OUTPUT VOLTAGE	12 VDC @4.2 A
OUTPUT POWER-CONTINUOUS	50 W
OUTPUT POWER - PEAK	55 W
OPERATING TEMPERATURE	0°-50° C
EMI COMPLIANCE	CISPR11 CLASS B (EN55011)
OUTPUT NOISE P-P	1%

J2 OUTPUT
1) OUTPUT 1 (+)
2) OUTPUT 1 (+)
3) OUTPUT 1 (+)
4) RETURN
5) RETURN
6) RETURN

J1 AC INPUT
1) LINE
2)
3) NEUTRAL

NOTES:

1. SUPPLIER: CONDOR POWER SUPPLIES INC.
   2311 STATHAM PKWY.
   OXNARD, CA. 93033
   PART NO: GLM50-12-101

2. SUPPLY MUST BE APPROVED TO
   UL 2601 AND IEC 601-1

3. SUPPLIER REV. C OR HIGHER

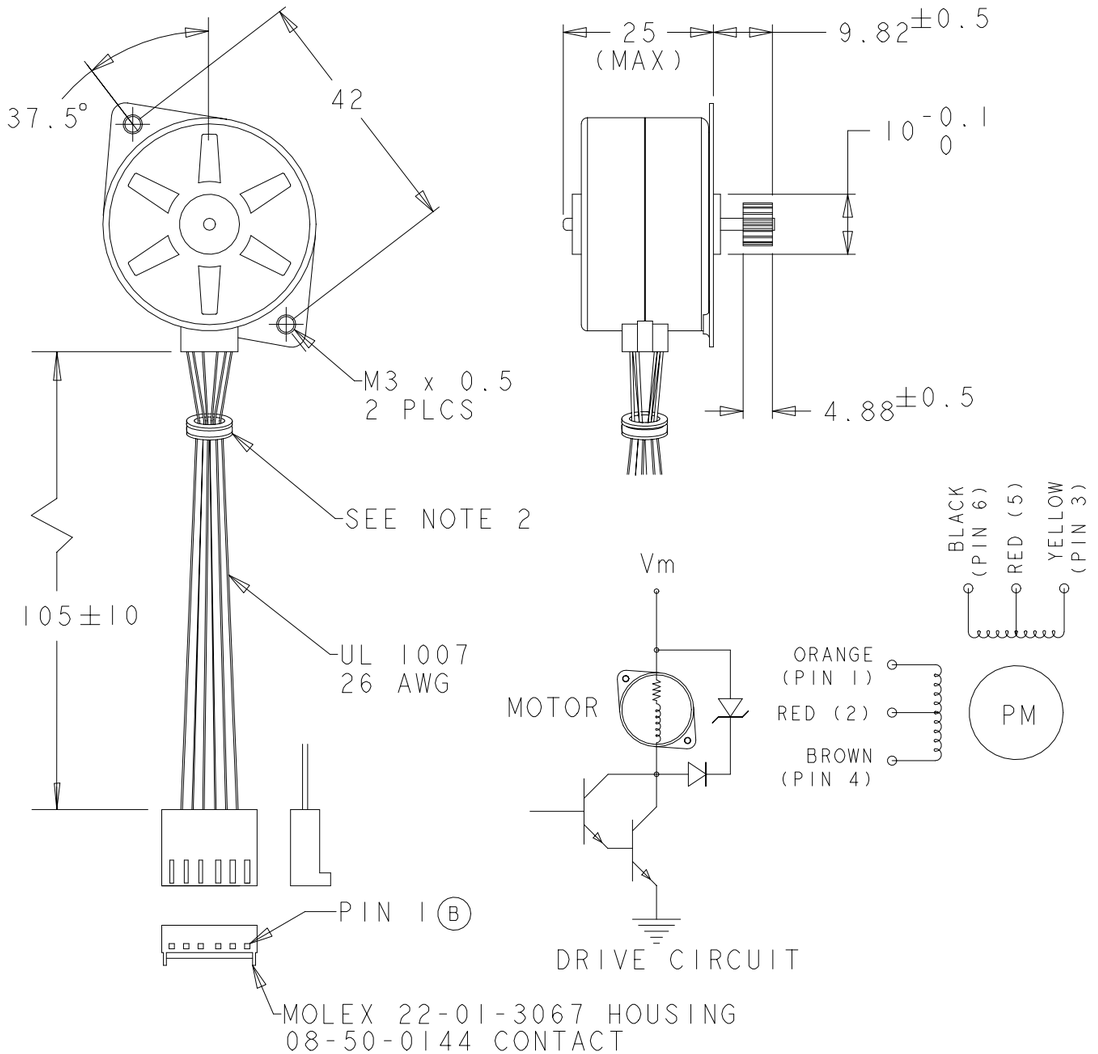
620150-1	REV B OR HIGHER
PART NO.	DESCRIPTION

DRAWN: ASK	DATE: 12-Jul-99	Welch Allyn®
APPROVED: ZIP	DATE: 7-12-99	MATERIAL: -
REL TO PROD: J. BELLO	DATE: 7-12-99	FINISH: -
-	-	TITLE: POWER SUPPLY, 50W
CAD SOFTWARE:	PRO/E	
TRANSLATED FROM:		

UNLESS OTHERWISE SPECIFIED
TOLERANCES .XX = ±.02 .XXX = ±.005 ANGLES ±2°
DIMENSIONS ARE IN INCHES

SIZE	DRAWING NO.	REV
B	620150	B
SCALE: DRAWING SCALE	SHEET 1 of 1	

REV	DESCRIPTION	ECN/ECO	INIT	DATE	CKD
A	RELEASE TO PRODUCTION (X16)	5-39056	JRS	2/25/99	T.W.
B	REVISED WIRING AND PIN LOCATIONS	5-39993	JRS	7/20/99	T.W.



GEAR DATA

NUMBER OF TEETH: 15
DIAMETRAL PITCH: 64
PRESSURE ANGLE: 20°
AGMA CLASS 6 OR BETTER
MATERIAL: BRASS CDA 360

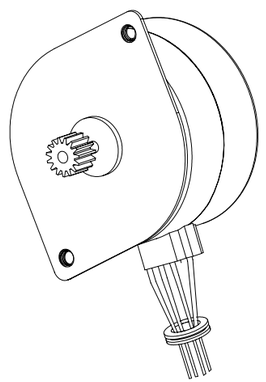
STEP	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6
	BLACK	RED	BROWN	YELLOW	RED	ORANGE
1	-	+	-		+	
2		+	-	-	+	
3		+		-	+	-
4	-	+			+	-

CW

CCW

(B) VIEWED FROM GEAR END

DIM'S ARE IN mm



NOTES:
1. NMB PART NO. 15BA-H056-T4P
   SPECIFICATIONS:
   12V UNIPOLAR WINDING
   DC RESISTANCE 30Ω
   STEP ANGLE 15°
   MAX HOLDING TORQUE 500 g-cm @ .4A/PHASE
   PULL OUT TORQUE 230 g-cm @ 330 pps
   PULL IN TORQUE 170 g-cm @ 330 pps
   NO LOAD SPEED 1000 pps MIN.
2. GROMMET SPECIFICATIONS:
   3/16 I.D. x 13/32 O.D. x 5/16 THK
   GROOVE Ø9/32 x 3/32
   MAY BE PURCHASED FROM AME, P/N 65GS-10
3. DIMENSIONS ARE FOR REFERENCE ONLY.

-	-
PART NO.	DESCRIPTION

DRAWN: MAHONEY	DATE: 19-Feb-99	Welch Allyn®
APPROVED: ZIP	DATE: 03/01/99	MATERIAL: -
REL TO PROD: J. BELLO	DATE: 02/26/99	FINISH: -
-	-	TITLE: MOTOR, STEPPER
CAD SOFTWARE:	ProE	
TRANSLATED FROM:	dxf	

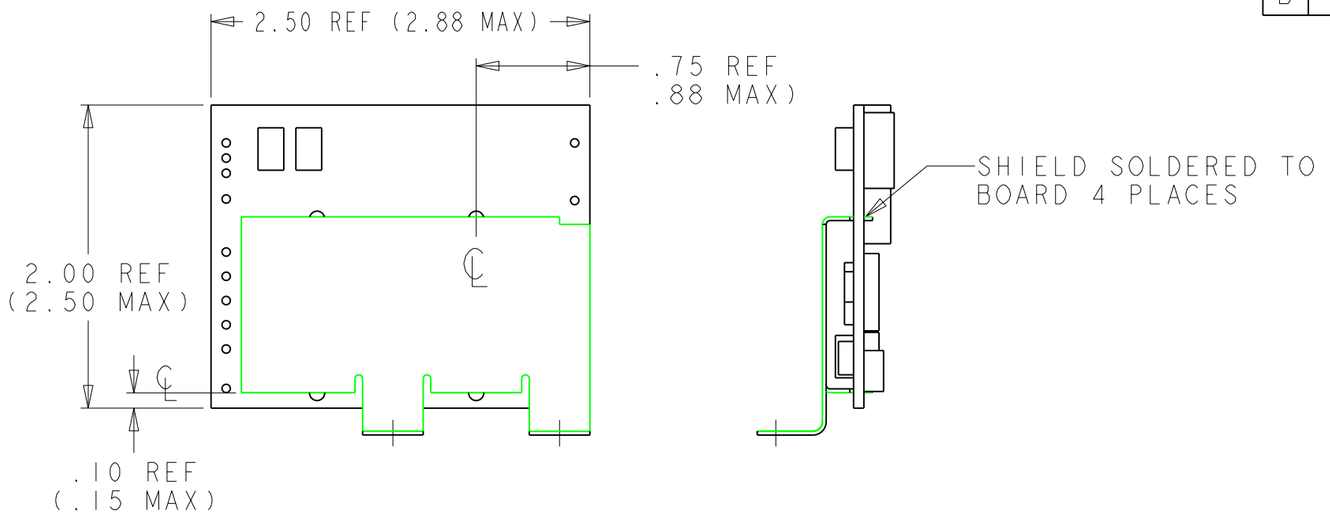
UNLESS OTHERWISE SPECIFIED
TOLERANCES DIMENSIONS ARE IN INCHES
.XX = ±.02
.XXX = ±.005
ANGLES ±2°

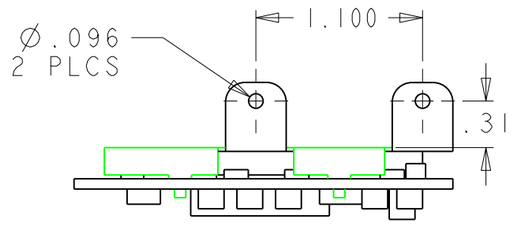
B	DRAWING NO. 620152	REV B
SCALE NONE	SHEET 1 of 1	

REV	DESCRIPTION	ECN/ECO	INIT	DATE	CKD
A	CHANGE	MT41168	DMC	5/8/97	TE
B	INTRODUCE 620154	MT41401	DMC	4/16/99	TE

125S210, 620154

SCALE 1.000





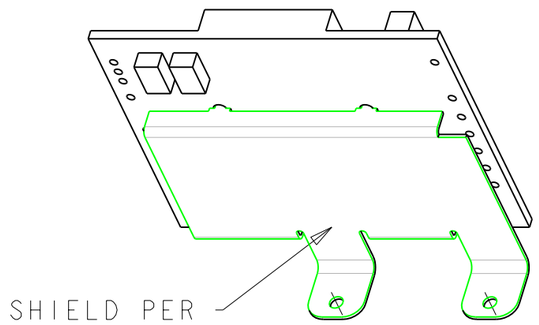
MANUFACTURER BOARD IDENTIFICATION:

1754 - XXX B

FIRMWARE PART NO.

REVISION

P/N: 620154 IS FOR USE BY SKANEATELES - THE PART IS THE SAME AS 125S210



SCALE 1.000

NOTES:

1. MANUFACTURER: NONIN MEDICAL, INC
   MINNEAPOLIS, MN
   P/N: 1771-003
2. BOARD TO MEET WELCH ALLYN SPECIFICATION 126P163.
3. PACKAGE INDIVIDUALLY WITH ESD PROTECTION.
4. MARK ASSEMBLY SERIAL NUMBER AND WELCH ALLYN P/N 125S210 IN ANY FREE AREA (LABEL PERMITTED).
5. WELCH ALLYN MUST BE NOTIFIED PRIOR TO ANY HARDWARE OR SOFTWARE CHANGE.

PART NO.	DESCRIPTION	REV
620154	ASSY, NONIN SPO2 BOARD	B
125S210	ASSY, NONIN SPO2 BOARD	A

DRAWN: D MCGLONE	DATE: 3/8/95	Welch Allyn®
APPROVED: B PIERCE	DATE: 4/15/99	MATERIAL: -
REL TO PROD: J HOWARD	DATE: 4/15/99	FINISH: -
T EDMONDSON	4/15/99	TITLE: ASSY, NONIN SPO2 BOARD WITH SHIELD
CAD SOFTWARE:	PRO-E	
TRANSLATED FROM:		

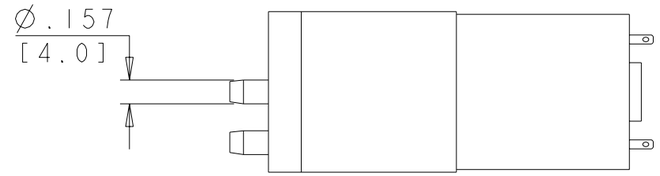
UNLESS OTHERWISE SPECIFIED
TOLERANCES DIMENSIONS ARE IN INCHES
.XX = ±.02
.XXX = ±.005
ANGLES ±2°

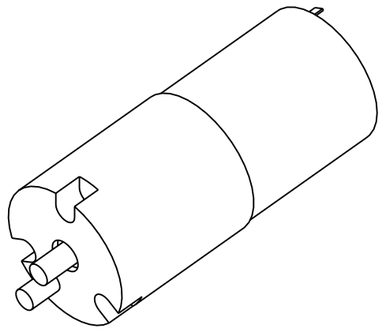
SIZE	DRAWING NO.	REV
B	125S210, 620154	B

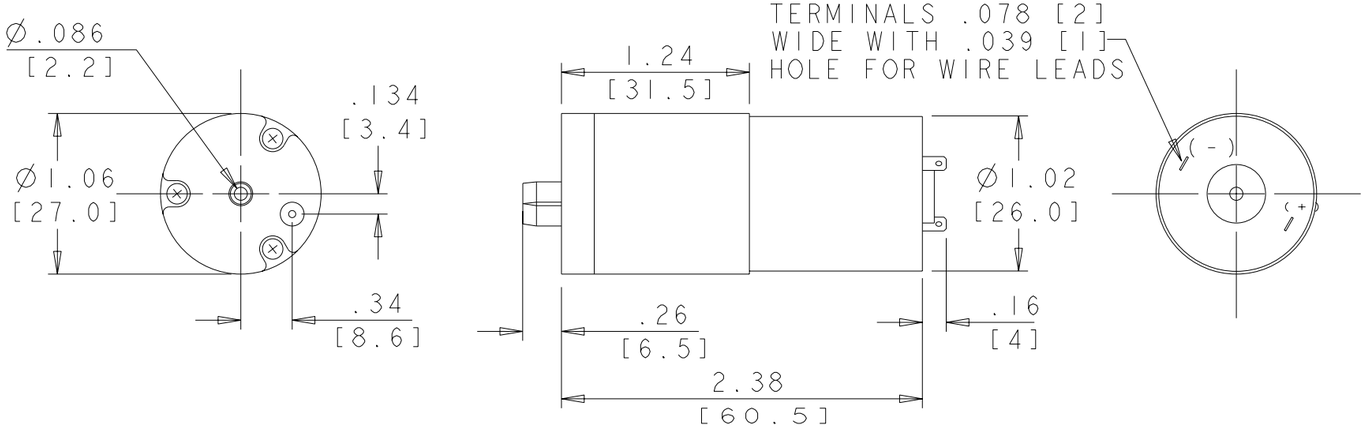
SCALE 1.000 SHEET 1 of 1

REV	DESCRIPTION	ECN/ECO	INIT	DATE	CKD
A	CHANGE	AMT40863-72	DMC	10/25/96	TE
B	INTRODUCE 620156	MT41401	DMC	4/16/99	TE

168S104, 620156







P/N: 620156 IS FOR USE BY SKANEATELES - THE PART IS THE SAME AS 168S104

NOTES:

1. PURCHASE FROM OKEN SEIKO CO., LTD, INAGI TOKYO, JAPAN
   PART NUMBER: P05C09.

2. DC MOTOR POWER REQUIREMENTS: RATED VOLTAGE: 6 VDC
   CURRENT: <500 mA MAX DURING PRESSURIZATION FROM 0-300 mmHg
   (STANDARD VOLUME OF 500 cc).

3. REFERENCE LEAK RATE: THE PUMP LEAK RATE WILL BE LESS THAN 15 mmHg IN 15 SECONDS WITH A 100±10 cc VOLUME PRESSURIZED TO 50 ±5 mmHg ATTACHED. THE PRESSURE IN THE VOLUME MUST BE STABILIZED FOR A MINIMUM OF 20 SECONDS BEFORE BEING ATTACHED TO THE PUMP. THE PUMP MUST BE RUN FOR A MINIMUM OF .75 SECONDS BEFORE BEING ATTACHED TO THE PRESSURIZED VOLUME.

4. PUMP UP SPEED: MUST PRESSURIZE STANDARD VOLUME OF 500 cc TO 5.8 PSI (300 mmHg) IN LESS THAN 10 SECONDS AT RATED POWER.

   FOR REF ONLY
   - MAXIMUM PRESSURE: 7.7 PSI (400 mmHg).
   - FLOW RATE: 2.0 LITERS / MINUTE AT NO LOAD
     1.0 LITERS/MIN AT 3.9 PSI (200 mmHg)

5. TEMPERATURE: AT 15% TO 90% RELATIVE HUMIDITY (NONCONDENSING)
   OPERATING: 0°C - +40°C, STORAGE: -20°C - +50°C

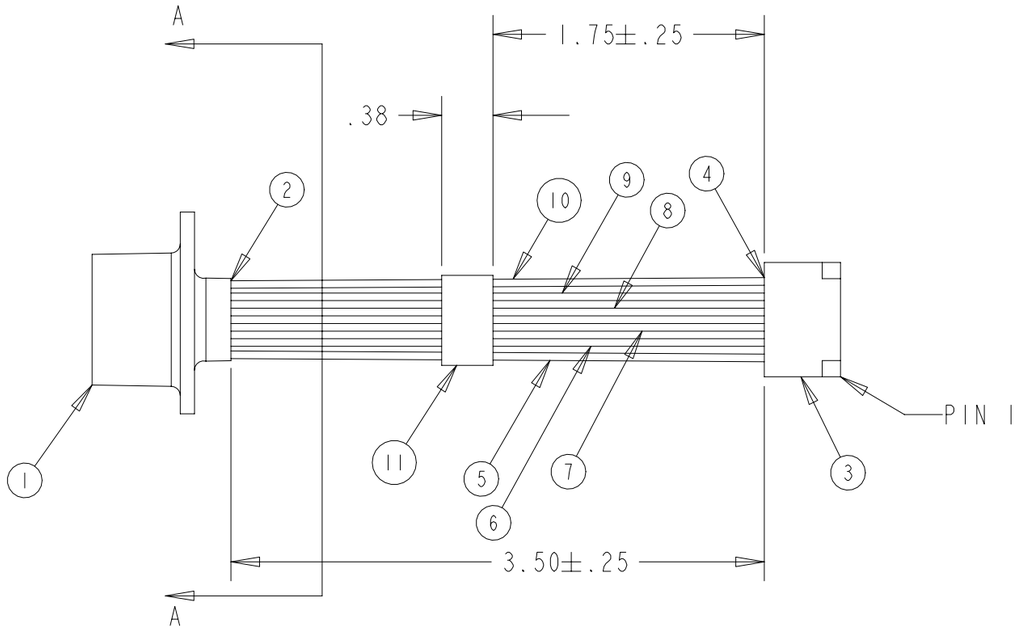
620156	PUMP, 6 VDC, 10 PSI	B
168S104	PUMP, 6 VDC, 10 PSI	A
PART NO.	DESCRIPTION	REV

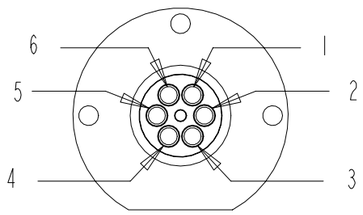
DRAWN D MCGLONE	DATE 4/3/95	Welch Allyn®
APPROVED B PIERCE	DATE 4/15/99	MATERIAL: -
REL TO PROD J HOWARD	DATE 4/15/99	FINISH: -
T EDMONDSON	4/15/99	TITLE: PUMP, PNEUMATIC, 6 VDC, 10 PSI
CAD SOFTWARE: PRO-E		
TRANSLATED FROM:		

UNLESS OTHERWISE SPECIFIED
TOLERANCES DIMENSIONS ARE IN INCHES
.XX = ±.02
.XXX = ±.005
ANGLES ±2°

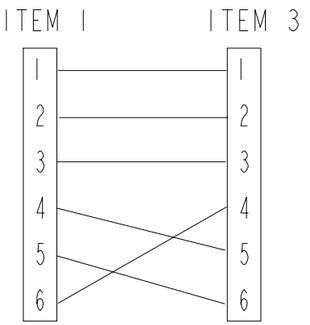
B	DRAWING NO. 168S104, 620156	REV B
SCALE 1.000	SHEET 1 of 1	

REV	DESCRIPTION	ECN/ECO	INIT	DATE	CKD
A	RELEASE TO PRODUCTION (X2)	5-39025	JRS	2/18/99	T.W.





SECTION A-A



NOTES:

1. ALL CONNECTORS ARE TO BE UL RECOGNIZED COMPONENTS AND CSA CERTIFIED. CONNECTOR MATERIAL SHALL HAVE FLAMMABILITY RATINGS OF 94V-2 OR BETTER.

2. WIRE SPECIFIATIONS

- -TYPE U.L. 1061, CSA AWM I A/B FTI
- -COLOR CODED .009 THK. (NOM) PVC INSULATION
- -TEMP RANGE: -10°C TO +80°C
- -VOLTAGE RATING: 300V
- -STRANDED TINNED COPPER CONDUCTOR
- -RECOGNIZED COMPONENT MARK RU AND CSA MUST APPEAR ON SPOOL OR BE STAMPED ON WIRE

QTY	ITEM	DESCRIPTION
1	11	SHRINK TUBE
1	10	WIRE, 22GA, GREEN
1	9	WIRE, 22GA, BROWN
1	8	WIRE, 22GA, BLUE
1	7	WIRE, 22GA, RED
1	6	WIRE, 22GA, BLACK
1	5	WIRE, 22GA, WHITE
6	4	CONTACTS, MOLEX 08-50-0113
1	3	6 PIN CONNECTOR, MOLEX 22-01-3067
6	2	ECG PINS (FEMALE), AMP-66105-3
1	1	ECG CONNECTOR WA PART # 620102

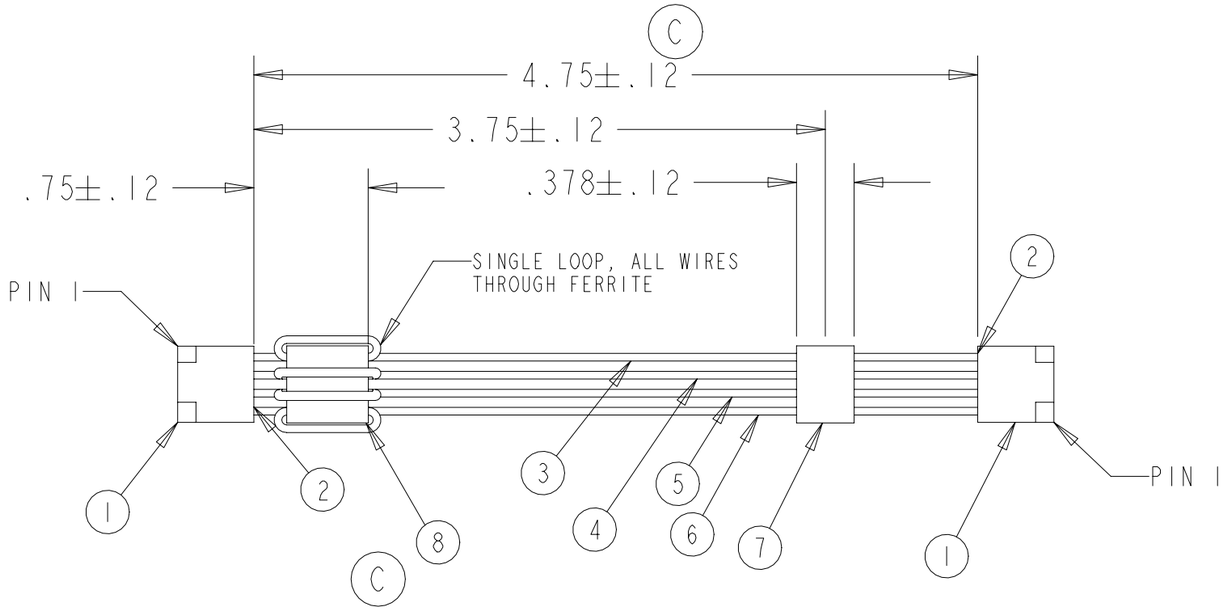
PART NO.	DESCRIPTION

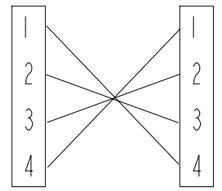
DRAWN: JB ENGEL	DATE: 13-Jan-99	Welch Allyn®
APPROVED: ZIP	DATE: 2/19/99	MATERIAL: -
REL TO PROD: J. BELLO	DATE: 2/19/99	FINISH: -
-	-	TITLE: CABLE ASSY ECG
CAD SOFTWARE:	PE	
TRANSLATED FROM:	ME10	

UNLESS OTHERWISE SPECIFIED
TOLERANCES: .XX = ±.02, .XXX = ±.005, ANGLES ±2°
DIMENSIONS ARE IN INCHES

B	DRAWING NO. 620165	REV A
SCALE NONE	SHEET 1 of 1	

REV	DESCRIPTION	ECN/ECO	INIT	DATE	CKD
A	RELEASE TO PRODUCTION (X2)	5-39025	JRS	2/18/99	T.W.
B	CHANGE WIRE SPEC IN NOTE 2	5-39543	JRS	5/5/99	T.W.
C	ADD .75" IN LENGTH ADD FERRITE CHANGED PART # 620166-1	5-39879	JRS	6/24/99	T.W.





NOTES:

1. ALL CONNECTORS ARE TO BE UL RECOGNIZED COMPONENTS AND CSA CERTIFIED.
   CONNECTOR MATERIAL SHALL HAVE FLAMMABILITY RATINGS OF 94V-2 OR BETTER.

2. WIRE SPECIFICATIONS

(B)
- -TYPE U.L. 1061, CSA AWM I A/B FTI
- -COLOR CODED .009 THK. (NOM) PVC INSULATION
- -TEMP RANGE: -10°C TO +80°C
- -VOLTAGE RATING: 300V
- -STRANDED TINNED COPPER CONDUCTOR
- -RECOGNIZED COMPONENT MARK RU AND CSA MUST APPEAR ON SPOOL OR BE STAMPED ON WIRE

(C)

QTY	ITEM	DESCRIPTION
1	8	FAIR RITE P/N 2643801902
1	7	SHRINK TUBE
1	6	WIRE, 22GA, YELLOW
1	5	WIRE, 22GA, ORANGE
1	4	WIRE, 22GA, RED
1	3	WIRE, 22GA, BROWN
8	2	CONTACTS, MOLEX 08-50-0113
2	1	4 PIN CONNECTOR, MOLEX 22-01-3047

PART NO.	DESCRIPTION
620166-1	THIS DRAWING REV C AND ABOVE
620166	

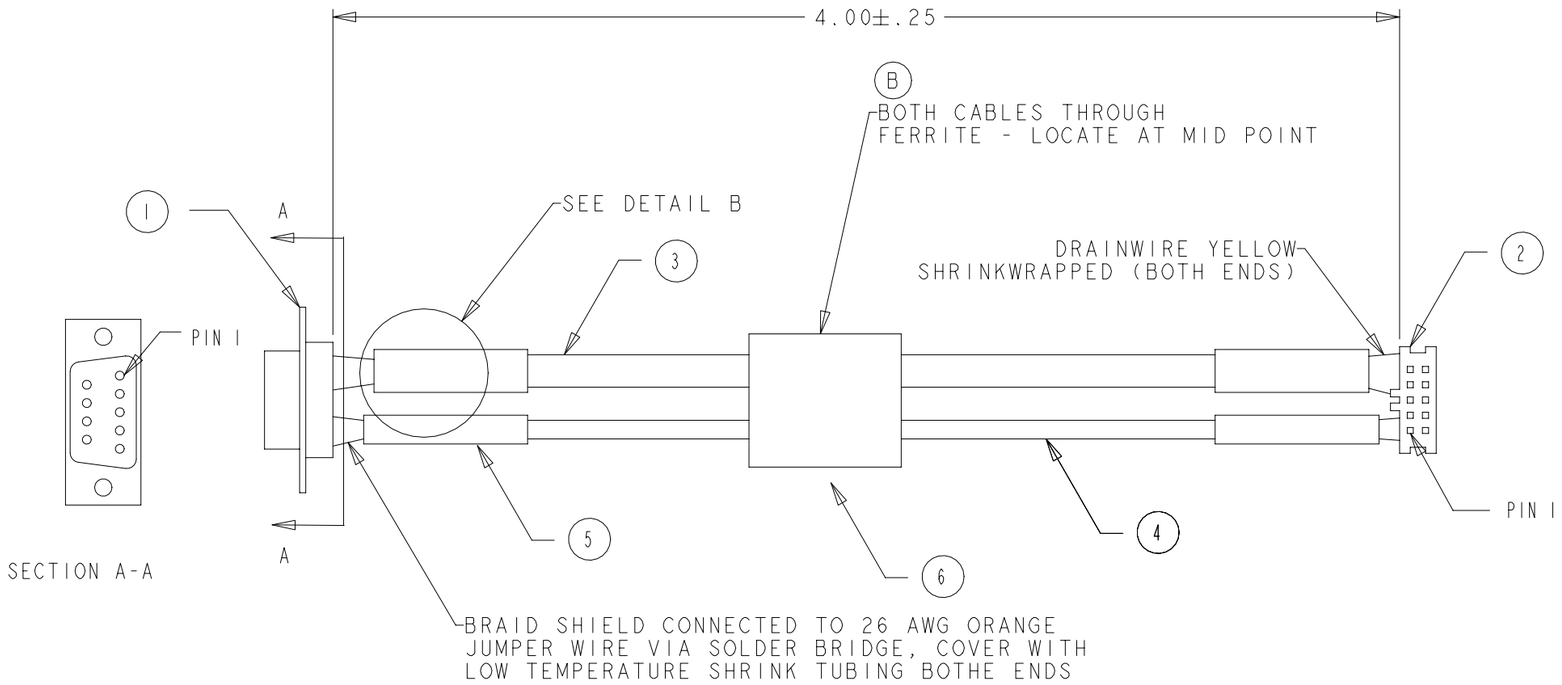
DRAWN: JB ENGEL	DATE: 13-Jan-99	Welch Allyn®
APPROVED: ZIP	DATE: 2/19/99	MATERIAL: -
REL TO PROD: J. BELLO	DATE: 2/19/99	FINISH: -
-	-	TITLE: CABLE ASSY C02
CAD SOFTWARE:	PE	
TRANSLATED FROM:	ME10	

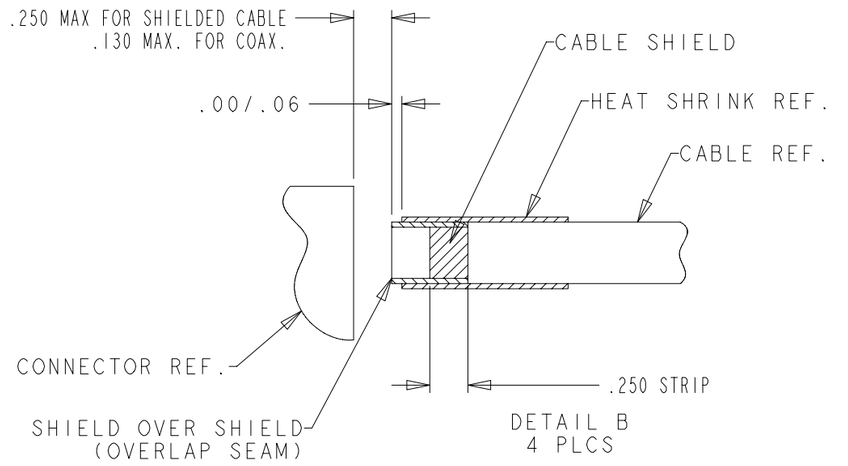
UNLESS OTHERWISE SPECIFIED
TOLERANCES .XX = ±.02 .XXX = ±.005 ANGLES ±2°
DIMENSIONS ARE IN INCHES

SIZE	DRAWING NO.	REV
B	620166	C

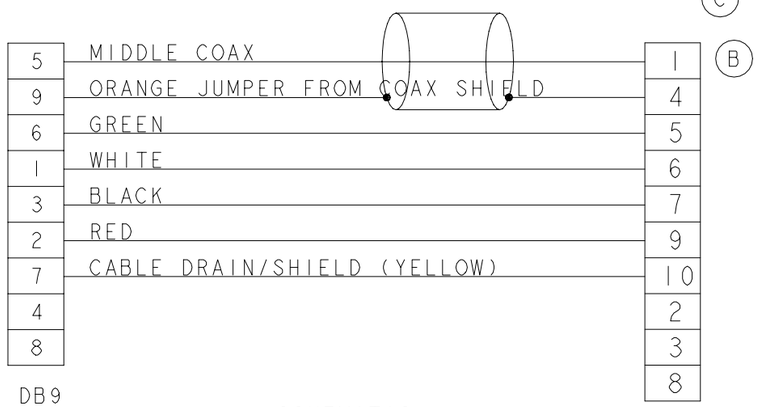
SCALE NONE | SHEET 1 of 1

REV	DESCRIPTION	ECN/ECO	INIT	DATE	CKD
A	RELEASE TO PRODUCTION (X2)	5-39025	JRS	2/18/99	T.W.
B	ADD FERRITE, ITEM 6 CHANGED PART NO. TO 620169-1	5-39627	JRS	5/14/99	T.W.
C	CHANGE CONN. TO METAL SHELL CHANGED PART NO. TO 620169-2	5-39885	JRS	6/29/99	T.W.





B	QTY	ITEM	DESCRIPTION
	1	6	FAIR-RITE 2643625102
	4	5	HEAT SHRINK
	1	4	COAX CABLE, BELDON#8216
	1	3	SHIELDED CABLE, CAROL#C0742 W/ DRAIN
	1	2	3M CONNECTOR, 89110-0101
C	1	1	SPO2 CONNECTOR, AMP #745491-2



C	620169-2	THIS PART REV C AND ABOVE
B	620169-1	THIS PART REV B AND ABOVE
	620169	THIS PART
	PART NO.	DESCRIPTION

DRAWN	DATE	Welch Allyn®
JB ENGEL	14-May-99	
APPROVED	DATE	MATERIAL:
ZIP	2/18/99	-
REL TO PROD	DATE	FINISH:
J. BELLO	2/18/99	-
-	-	TITLE: CABLE ASSY NELLCOR SENSOR
CAD SOFTWARE:	PE	
TRANSLATED FROM:	ME10	

UNLESS OTHERWISE SPECIFIED
TOLERANCES DIMENSIONS ARE IN INCHES
.XX = ±.02
.XXX = ±.005
ANGLES ±2°

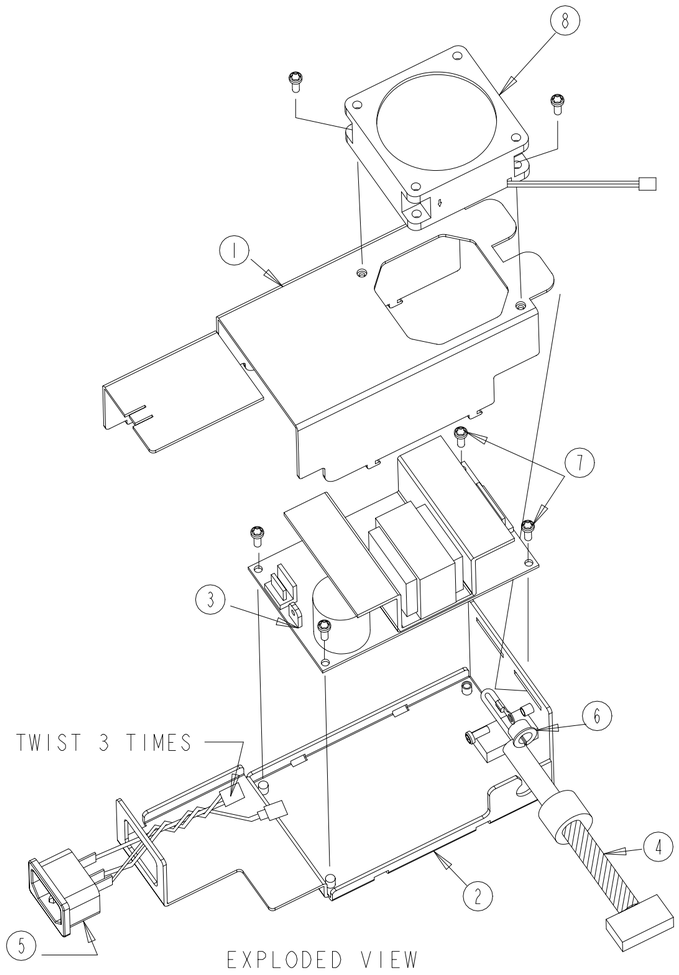
B	DRAWING NO. 620169	REV C
SCALE NONE	SHEET 1 of 1	

NOTES:

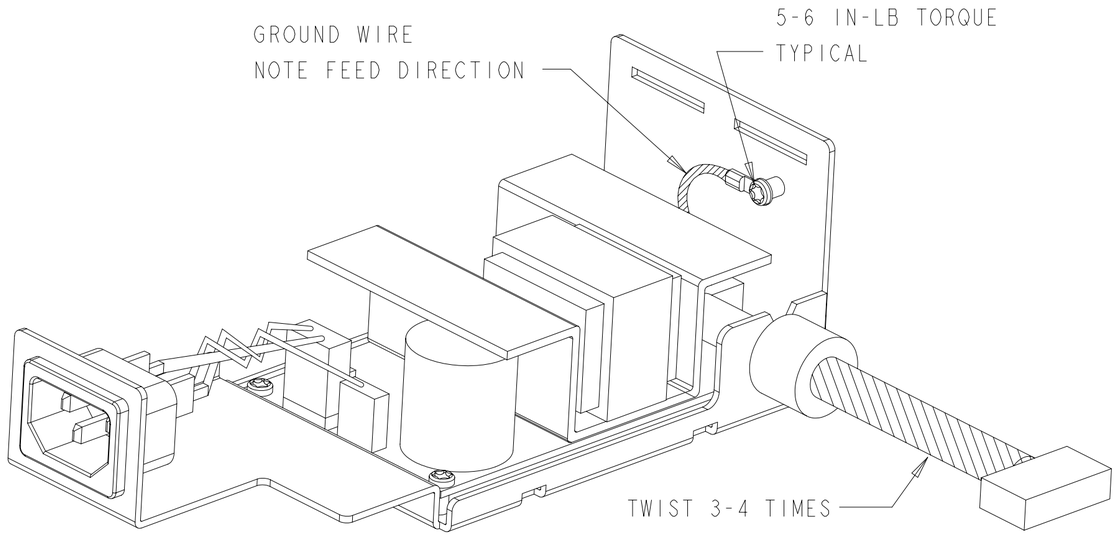
1. ALL CONNECTORS ARE TO BE UL RECOGNIZED COMPONENTS AND CSA CERTIFIED.
   CONNECTOR MATERIAL SHALL HAVE FLAMMABILITY RATINGS OF 94V-2 OR BETTER.

2. CABLE ASSEMBLY TO BE 100% TESTED FOR POINT TO POINT
   AND SHIELD OVER SHIELD CONTINUITY.

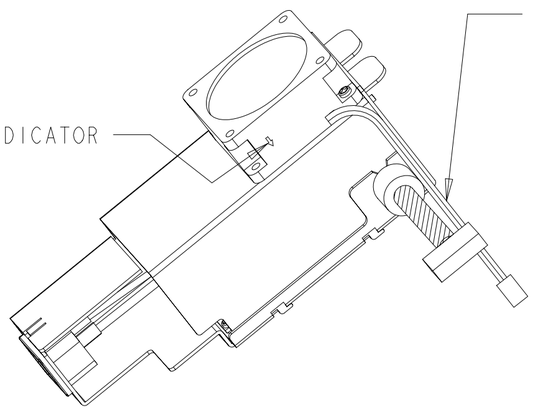
REV	DESCRIPTION	ECN/ECO	INIT	DATE	CKD
A	RELEASE TO PROD. ENG.	5-39387	JRS	4/15/99	T.W.

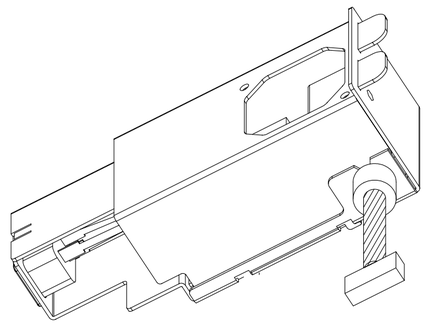


EXPLODED VIEW



PARTIAL ASSEMBLY



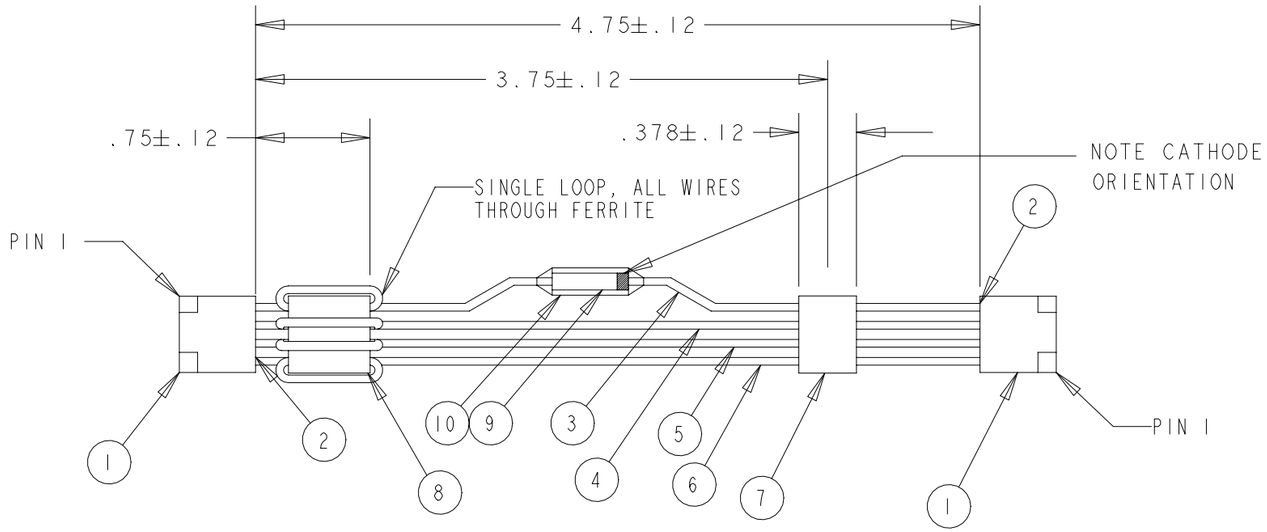


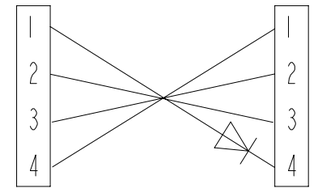
620201-502	SUB-ASSEMBLY WITH FAN
620201-501	SUB-ASSEMBLY WITHOUT FAN
PART NO.	DESCRIPTION

DRAWN JB ENGEL	DATE 13-Apr-99	Welch Allyn®
APPROVED ZIP	DATE 4/15/99	MATERIAL: -
REL TO PROD J. BELLO	DATE 4/15/99	FINISH: -
-	-	TITLE POWER SUPPLY\ SUB-ASSEMBLY
CAD SOFTWARE:	PRO E	
TRANSLATED FROM:	ME-10	
UNLESS OTHERWISE SPECIFIED TOLERANCES .XX = ±.02 .XXX = ±.005 ANGLES ±2° DIMENSIONS ARE IN INCHES	C	DRAWING NO. 620201 REV A
	SCALE NONE	SHEET 1 of 1

620201X1.MI

REV	DESCRIPTION	ECN/ECO	INIT	DATE	CKD
A	RELEASE TO PRODUCTION	5-39928	JRS	7/2/99	T.W.





QTY	ITEM	DESCRIPTION
1	10	CLEAR HEAT SHRINK
1	9	DIODE, MOTOROLA P/N IN4148
1	8	FAIR RITE P/N 2643801902
1	7	SHRINK TUBE
1	6	WIRE, 22GA, YELLOW
1	5	WIRE, 22GA, ORANGE
1	4	WIRE, 22GA, RED
1	3	WIRE, 22GA, BROWN
8	2	CONTACTS, MOLEX 08-50-0113
2	1	4 PIN CONNECTOR, MOLEX 22-01-3047

NOTES:

1. ALL CONNECTORS ARE TO BE UL RECOGNIZED COMPONENTS AND CSA CERTIFIED.
   CONNECTOR MATERIAL SHALL HAVE FLAMMABILITY RATINGS OF 94V-2 OR BETTER.

2. WIRE SPECIFICATIONS

   -TYPE U.L. 1061, CSA AWM I A/B FTI

   -COLOR CODED .009 THK. (NOM) PVC INSULATION

   -TEMP RANGE: -10 °C TO +80 °C

   -VOLTAGE RATING: 300V

   -STRANDED TINNED COPPER CONDUCTOR

   -RECOGNIZED COMPONENT MARK RU AND CSA MUST APPEAR ON SPOOL OR BE STAMPED ON WIRE

PART NO.	DESCRIPTION

DRAWN JB ENGEL	DATE 13-Jan-99	Welch Allyn®
APPROVED CDM	DATE 7/2/99	MATERIAL: -
REL TO PROD J. BELLO	DATE 7/2/99	FINISH: -
-	-	TITLE: CABLE ASSY CO2
CAD SOFTWARE:	PE	
TRANSLATED FROM:	ME10	

UNLESS OTHERWISE SPECIFIED
TOLERANCES .XX = ±.02 .XXX = ±.005 ANGLES ±2°
DIMENSIONS ARE IN INCHES

B	DRAWING NO. 620524	REV A
SCALE NONE	SHEET 1 of 1	

Equipment for perfoming Safety Tests on the Atlas Monitor:

CAUTION : High Voltages are generated and used during the HI-Pot or Dielectric Test. DO NOT OPERATE THIS EQUIPMENT AND OR RUN THIS TEST UNLESS YOU HAVE BEEN PROPERLY TRAINED AND ARE QUALIFIED ON THIS PROCEDURE!

Description	Tool #	Company
Modified AC Cord	T-16761	Welch Allyn
Safety Analizer	601 Pro Series	BioTek
Hi-Pot	Model 3500D	Associated Research
AC Power Source	Model EW 371	Elgar

Test Procedure for Atlas Safety Test Station

Leakage Test Procedure:

1. Verify that all plugs removed from the Elgar AC Power Source and the Biotek 601 Pro Safety Tester
2. Turn on EW371 Elgar Supply
3. Set Voltage and Frequency (240VAC, 50 Hz) after self-test has completed
   Key strokes: [Shift] [Range (300v)] [Shift] [2] [4] [0] [Enter] [V/F (frequency)] [5] [0] [Enter] [Out]
4. Plug in Biotek 601 Pro to front panel and power up Biotek.
5. Toggle [Class/Type] button until Class I, Type CF displayed on Main Menu if necessary.
6 Select Test Standard IEC601-1 by pressing the [More] key and then toggling the [Down Arrow]. Then select with [Enter]. Once selected press [ESC]
7. Connect ECG leads to Biotek in accordance with color code directly above the top row of sockets: AP/RA (wht), RL (grn), LA (blk), LL (red), V1 (brn)
8. Select Patient Leakage Current Connections: All-Earth[up/down arrows], Norm Pol [polarity], Earth[earth], L2[L2], Class I Type CF. (no indicator lights are on in outlet control panel [dual rev. pol, no earth, no L2: all off])
9. Select Patient Leakage #7 to provide AC power to Biotek AC socket.
10. Turn on Atlas Monitor.
11. Press Mains on Applied Part #8.
11. Record All-Earth:Norm and All-Earth:Rev result (pass/fail) on Atlas Monitor Test Result form. If failure, then place unit on Debug shelf.
12. Press Patient Leakage uA #7.
13. Record Patient Leakage result (pass/fail) on Atlas Monitor Test Result form. If failure, then place unit on Debug shelf.
14. Turn off Atlas Monitor.
15. Remove ECG cable from Atlas.
16. Remove AC cord if no printer and proceed to Dielectric Tests.
17. If printer, continue to Ground Continuity Test.

Ground Continuity Test (Printer Models Only)

1. Press [Earth Resistance] key (#4)
2. Toggle [Test Current] key (#5) until Test Current is 1A if necessary
3. Plug red test lead from Front Panel red jack to green jack
4. Press [Cal] to calibrate test lead
5. After calibration complete, remove red lead from green jack and place red clip on red lead tip
6. Attach red lead from 601Pro to printer motor case
7. Press [Earth Resistance] (#4)
8. Record Earth Resistance result (pass/fail) on Atlas Monitor Test Result form. If failure, then place unit on Debug shelf.
9. Press [ESC] key
10. Remove red lead from jack and printer motor
11. Disconnect AC cord from Atlas and continue to Dielectric Test.

Leakage Test Procedure after First Run of Day

1. Verify Output Voltage and Frequency of EW371 Power Supply (240VAC, 50 Hz)
2. Plug power cord from Biotek 601Pro into Atlas Monitor.
3. Verify ECG Lead Connection to Biotek 601 Pro.
4. Connect ECG plug from Biotek to Atlas Monitor.
5. Select Patient Leakage #7 to provide AC power to Biotek AC socket.
6. Turn on Atlas Monitor.
7. Press Mains on Applied Part #8.

8. Record All-Earth:Norm and All-Earth:Rev result (pass/fail) on Atlas Monitor Test Result form. If failure, then place unit on Debug shelf.
9. Press Patient Leakage uA #7.
10. Record Patient Leakage result (pass/fail) on Atlas Monitor Test Result form. If failure, then place unit on Debug shelf.
11. Turn off Atlas Monitor.
12. Remove ECG cable from Atlas.
13. Remove AC cord if no printer and proceed to Dielectric Tests.
14. If printer, continue to Ground Continuity Test.

Ground Continuity Test (Printer Models Only)

1. Attach red lead from 601Pro to printer motor case
2. Press [Earth Resistance] (#4)
3. Record Earth Resistance result (pass/fail) on Atlas Monitor Test Result form. If failure, then place unit on Debug shelf.
4. Press [ESC] key
5. Remove red lead from jack and printer motor
6. Disconnect AC cord from Atlas

At conclusion of last test of day, turn off Biotek 601Pro and Elgar power supply EW371.

CAUTION : High Voltages are generated and used during the HI-Pot or Dielectric Test. DO NOT OPERATE THIS EQUIPMENT AND OR RUN THIS TEST UNLESS YOU HAVE BEEN PROPERLY TRAINED AND ARE QUALIFIED ON THIS PROCEDURE!

Dielectric Test

Three tests will be performed for Dielectric Withstand.

1. Mains to Instrument Common: 1500 VAC
2. Mains to ECG Output: 4000 VAC
3. Mains to Isolated RS232 (Models 210/220 only): 4000 VAC

Mains to Instrument Common: 1500 VAC

A. Connect the modified AC cord (Connection 1: hot and neutral joined, Connection 2: earth ground) to the back of the Atlas Monitor.
B. Connect the black clip lead to the return jack of the Hypot 3500 Dielectric tester.
C. Connect the red clip lead to the HV jack of the Hypot 3500 Dielectric tester.
D. Turn on 3500D. Press [Set]
E. Set voltage to 1500 VAC with [up]/[down] buttons
F. Press [Set]
G. Set current limit to 3 mA with [up]/[down] buttons

H. Press [Set]
I. Set Timer to 60 seconds with [up]/[down] buttons
J. Press [Set]
K. Set Continuity off.
L. Scroll through settings with [Set] button.
M. When settings verified, press [Exit] button.
N. Connect Red Clip lead to joined Hot and Neutral lines of the test connector
O. Connect Blk Clip lead to grd wire of the modified AC cord.
P. Position electrical leads at rear of test bench
Q. Press green [Test] button. Wait for 60 seconds.
R. Record current: _____mA

Mains to ECG Output: 4KV

A. Plug modified ECG cables into ECG connector at front of Atlas unit.
B. Connect the modified AC cord (hot, neutral, and earth ground connected) to the back of the Atlas Monitor.
C. Connect the black lead banana plug to the return jack of the Hypot 3500 Dielectric tester.
D. Connect the red lead banana plug to the red jack of the Hypot 3500 Dielectric tester.
E. Turn on 3500D. Press [Set]
F. Set voltage to 1500 VAC with [up]/[down] buttons
G. Press [Set]
H. Set current limit to 3 mA with [up]/[down] buttons
I. Press [Set]
J. Set Timer to 60 seconds with [up]/[down] buttons
K. Press [Set]
L. Set Continuity off.
M. Scroll through settings with [Set] button.
N. When settings verified, press [Exit] button.
O. Connect the red clip lead from HV Jack of Hypot 3500D to modified AC connector cord with all lines connected (Hot, Neutral, and Ground)
P. Connect Blk Clip lead to common connection of joined ECG leads
Q. Position electrical leads at rear of test bench
R. Press green [Test] button. Wait for 60 seconds.
S. Record current: _____mA

Mains to Isolated RS232 (Models 210/220 only): 4000 VAC

A. Plug modified RS232 cable (all wires connected) into the RS232 connector at rear of Atlas unit.
B. Connect the modified AC cord (hot, neutral, and earth ground connected) to the back of the Atlas Monitor.
C. Connect the black lead banana plug to the return jack of the Hypot 3500 Dielectric tester.
D. Connect the red lead banana plug to the HV jack of the Hypot 3500 Dielectric tester.
E. Apply power to 3500D. Press [Set]
F. Set voltage to 1500 VAC with [up]/[down] buttons
G. Press [Set]
H. Set current limit to 3 mA with [up]/[down] buttons
I. Press [Set]
J. Set Timer to 60 seconds with [up]/[down] buttons
K. Press [Set]
L. Set Continuity off.
M. Scroll through settings with [Set] button.
N. When settings verified, press [Exit] button.
O. Connect the red clip lead from HV Jack of Hypot 3500D to modified AC connector cord with all lines connected (Hot, Neutral, and Ground)
P. Connect Blk Clip lead to common connection of joined RS232 leads
Q. Position electrical leads at rear of test bench
R. Press green [Test] button. Wait for 60 seconds.
S. Record current: _____mA

Atlas Test Results

Model #:				
Serial #:				
Repaired by: Time & Date of Repair: ___:____ / /				
Tested by: Time & Date of Test: ___:____ / /				
LED Button test				
BIOTEK Test Results				
Patient Leakage test (10uA Maximum)				
Mains on applied part (50 uA Maxlmum)				
tarth Resistance (printer only) (.200 Ohms Max)				
Dielectric **Withstand Test Results**				
Mains to tarth @ 1.5kV (3mA Max)				
Mains to tarth @ 4.0kV (3mA Max)				
Mains to isolation RS232 @ 4 kV (3mA Max)				
Other				
Functional Tests Results				
Initialize				
Battery				
Power Supply				
Blood Pressure				
SpO2				
Kespiration				
ECG 1				
ECG 2				
ETCO,				
Temperature				
Other				
Failure Detail I Made				